

DOCUMENT RESUME

ED 153 655

IR 006 050

TITLE Drug Information in Minnesota. The Final Report of the Drug Information Task Force.

INSTITUTION Minnesota Univ., Minneapolis. Health Sciences Center.

PUB DATE Apr 78

NOTE 79p.; Due to small print size, flowcharts may not reproduce clearly

EDRS PRICE MF-\$0.83 HC-\$4.67 Plus Postage.

DESCRIPTORS Financial Support; Flow Charts; *Health Personnel; Health Services; Information Needs; *Information Services; Medicine; *Needs Assessment; *Systems Analysis; Tables (Data)

IDENTIFIERS *Drugs

ABSTRACT

The rapid increase in the number of new compounds available to treat human disease has not been matched by corresponding changes in the manner of storing and retrieving this information. In this final report, a task force identifies the present and future drug information needs of health care professionals and laymen of the local and regional community; outlines a provisional list of information needs which a drug information center should address; and recommends methods by which these needs can be met, identifying such specifics as cost, library resources, and personnel necessary, given existing and/or projected funding. (MBR)

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DRUG INFORMATION IN MINNESOTA

THE FINAL REPORT OF THE DRUG INFORMATION TASK FORCE

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UNIVERSITY OF MINNESOTA HEALTH SCIENCES CENTER

MINNEAPOLIS, MINNESOTA

APRIL, 1978

IR006050

"...There will be no real improvement (in health care delivery) until the delivery of health care information has met the same goals that the nation has set for the delivery of health care itself."^(a)

(a) From Sewell, W. F., "Guide to Drug Information", Drug Intelligence Publications, Hamilton, Ill. 1976, p. 165.

Summary and Recommendations

The University of Minnesota Hospitals Drug Information Task Force

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The results of the efforts of the Task Force are presented here in summary and recommendation format. Specific recommendations are referenced to the body of the larger main report for ease of location for the reader. Many of the items in the main report, upon which the recommendations are based, required extensive literature research and the reader is encouraged to consult the various tables and figures at the end of this report.

In summary, the recommendations of the Task Force are:

1. That, based on an analysis of many operational information systems, a system be implemented based upon the Drug Information Center (DIC) concept to meet as many of the stated criteria as possible (see III, Systems for the Provision of Drug Information, Section B, page 8).
2. That a survey of health care professionals in Minnesota be undertaken to determine their recognized drug information needs.

3. That the potential beneficiaries of DIC service be surveyed as to their willingness to provide funding for future support for operational budgets.
4. That the completed survey modify to the extent feasible the system proposed (see II. Types of Drug Information Needed, Section B, page 3).
5. That the DIC concept be implemented (see III. Systems for the Provision of Drug Information, Section C, page 21) to serve regional needs identified by the survey and to foster sub-center development.
6. That there be a time and motion study done in the present University Hospitals DIC for the purpose of making realistic workload predictions and that those statistics be used to reply to cost-oriented questions and sub-center development.
7. That adequate space and location be found immediately to meet the needs of the present Drug Information Center (characteristics specified in item 3. Space and Location, letters a-j, page 23).
8. That resources be provided to find and secure an optimal location for the future site of the DIC.
9. That a mechanism be found to monitor the progress toward implementation of the proposed system.
10. That health professionals pay at least part of the cost of providing accurate and unbiased drug information to them.
11. That federal, state, and local government units, major insurance providers, and foundations be approached to provide one-time grants for the development and implementation of the DIC.
12. That affiliation be undertaken with Diehl Hall Biomedical Library.
13. That subscriptions (or contract services) form a significant portion of long-range funding of the DIC.
14. That methods be investigated to establish expanded hours of operation as soon as short-term and preferably long-term funds become available.
15. That search capabilities include the ability to search and report within minutes (short time period) for verbal replies and the ability to search and report with hard copies within one working day. (Specific systems referred to are, for example, Iowa System and Medline.)

16. That replies, at the requestor's discretion, be in the form of written recommendations from the literature and in addition may contain a list of citations and/or documents.
17. That hard copy files serve as the primary source of the DIC services until the value and cost-benefits of a computer data base allowing automated retrieval can be determined.
18. That hard copy files include quick access to frequently posed questions and investigational drug questions.
19. That personnel providing answers or supervising replies be clinically trained pharmacists who regularly maintain competence by actual clinical practice.
20. That a panel of users be established to routinely audit the quality of information given by the three College of Pharmacy supported Information Services.
21. That a "column" be regularly established in the Minnesota Pharmacist and/or Minnesota Medicine to advertise the DIC's offerings and capabilities and to communicate common questions with answers to health professionals in Minnesota.
22. That selected DIC staff actively contribute in the drug information area to the research, education, and service components of the College of Pharmacy with the approval of the Clinical Chief of Pharmaceutical Services, University Hospitals.
23. That a search committee be formed to obtain credentials and review applications for a "Director of Drug Information" position.
24. That a high priority of the DIC be the gathering of data which would support the hypothesis that the DIC directly or indirectly improves patient care outcomes.

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I. INTRODUCTION

The fields of Medicine and Pharmacy have experienced an information explosion secondary to the rapidly increasing number of new compounds available for the treatment of human disease. In 1945, there were only a few compounds available for the treatment of human disease. In 1978, there are approximately 3,700 separate chemical entities available¹ and these chemical entities are combined and recombined into well over 25,000 products.² This rapid increase in the number of compounds available has stimulated research to discover even more new compounds. Unfortunately, these quantum leaps in our understanding of drugs have not been matched by corresponding changes in the manner in which information is stored and retrieved. Unfortunately, this information is poured into archaic, ineffective, and obsolete information systems (see Appendix A).

The Millis Commission recognized this problem when it stated that "...The system of pharmacy cannot be described at present as either effective or efficient in developing, organizing, and distributing knowledge and information about drugs".³ The late Hubert H. Humphrey also called for significant improvements in the system of storing and retrieving information in the health sciences.⁴ Others have similarly decried the lack of a cogent information system.⁵

The University of Minnesota Hospitals Drug Information Center has attempted to provide such a system; however, funding for this Center can be described as marginal at best. An intradepartmental review of manpower requirements for the current levels of service recently indicated that the Center would need 3.3 fulltime equivalent (FTE) pharmacists and 1.0 FTE secretary to function at a high level of quality.⁶ The Center is currently staffed by 2.5 FTE pharmacists and less than 0.5 FTE secretaries. In addition, the 2.5 FTE pharmacists are not fully devoted to Drug Information Center activities.

The University of Minnesota Hospitals Drug Information Task Force is in the process of re-evaluating services to be provided and the manner for their provision. The charges identified to the Task Force were:

1. Identify the present and future drug information needs of the University Hospitals staff and patients, the College of Pharmacy faculty and students, and the community professionals and laymen.
2. Recommend those information needs which the University Hospitals Drug Information Center should address.

3. Recommend how the needs can best be met identifying the costs, library resources, personnel, hours of operation, etc., necessary given existing and/or projected funding approaches.
4. Recommend the optimal organization of the University Hospitals Drug Information Center internally and within the Department of Pharmaceutical Services management structure.

With the exception of the fourth charge, the Task Force undertook a response to each charge via a separate report. These reports have been combined and modified to form the present report. The Task Force deferred action on the fourth charge and recommended that the Clinical Chief of Pharmaceutical Services take action on that issue.

II. TYPES OF DRUG RELATED INFORMATION NEEDED BY HEALTH CARE PROFESSIONALS AND THE PUBLIC

A. Introduction

Three publications are available which discuss the drug information needs of health care practitioners. The first was published by the Food and Drug Administration in 1974.⁷ They surveyed 15,000 physicians and no other health care practitioners. The highest degree of interest generated was for a "computerized link to a university based consultant" (68% of respondents). There was no attempt to systematically outline the type or degree of information needed by the physician but the major types of information mentioned by this report are: dosage, adverse reactions, cost, uses, mechanism of action, formulation, interactions, new drugs, and quality information. There is no mention in the report of how these were determined to be the types of information needed by physicians. The second publication is from the Department of Health Education and Welfare⁵ and purports to review the needs of the health population in general. This publication does not report the findings of a survey. It sets down a list of drug information needs of researchers, physicians, nurses, pharmacists, and patients presumably as experienced by the author. These are summarized in Table 1. The third publication⁸ reports the results of a survey of the information needs of 1213 nurses conducted by the American Journal of Nursing in late 1973 and early 1974. In this survey, the nurses were asked to rate the relative importance of various types of information identified by the surveyors. The relative importance assigned to the various types of information by the nurses is listed in Table 2.

Another major indicator of the information needs of health care practitioners may be obtained by examining the types of questions recorded by existing drug information centers. Admittedly, this information will be biased by the reputation of the given center, the predetermination of categories by drug information administrators and numerous other factors. Table 3 lists the types of questions experienced by several drug information centers.

Finally, Katz and Tribioletti⁹ have presented a summary of what information they feel pharmaceutical manufacturers ought to provide to clinical pharmacists. Presumably, this is an indication of what they feel are the information needs of the clinical pharmacist. Their summary is found in Appendix B.

B. A System Model

The Task Force recommends that a survey be done of health care practitioners and laypersons in Minnesota to determine what their recognized drug information needs are. In the interim, this report will present an integrated approximation of these needs made by: 1) analyzing a model of drug prescribing, 2) delineating a potential structure for a data base which contains the kinds of information needed by health care professionals in Minnesota, and 3) surveying other providers of drug information (Poison Center, Drug Information Service Center) associated with the University of Minnesota.

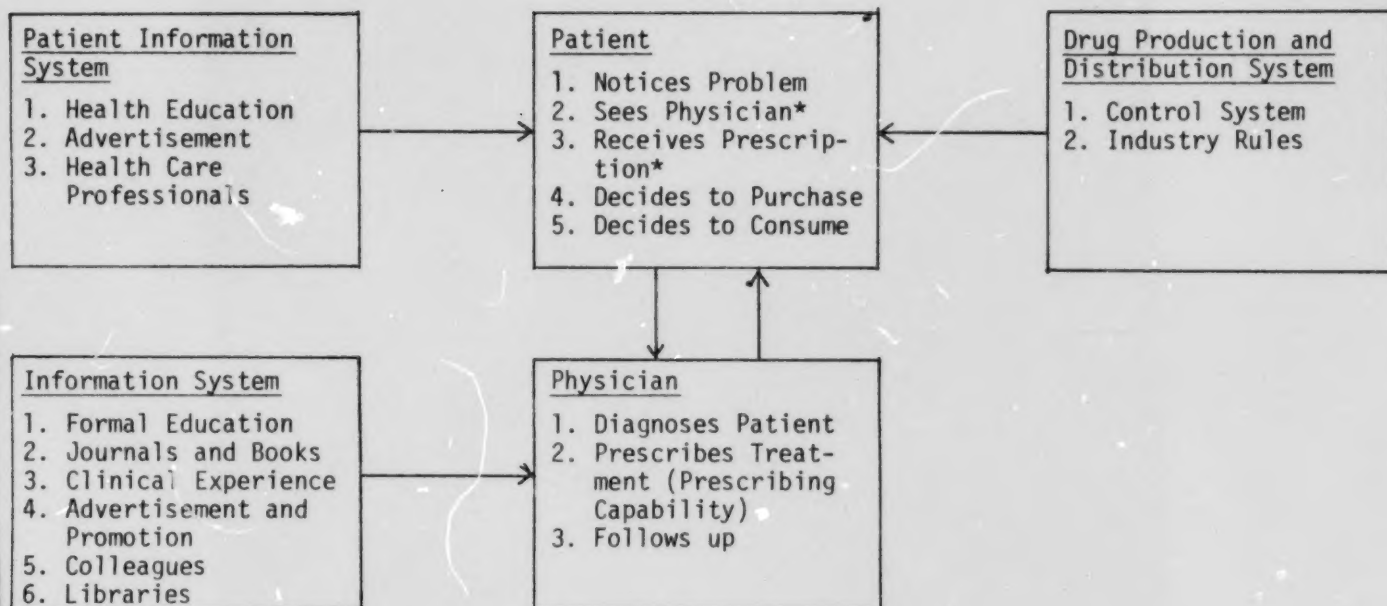
The model used will be based on that prepared by the "Council of Europe, European Public Health Community: Report by Work Party - 1975"¹⁰ (Figure A). By looking at the model in Figure A, one can observe that there are some basic requirements to be met before any drug can be given to a patient. By examining the model closely, one can discern that certain types of information are implicitly required by various health care professionals in order for the system to operate. These will be identified below as needs for each type of health care professional. Certain other types of information can be expected to make the system run more smoothly (e.g., making information on adverse drug reactions more accessible could reduce their incidence). Information that makes the system operate more smoothly are presented below as "should have" information needs.

The following are primary users of drug information.

1. Pharmacist

In order for a patient to receive a drug, the pharmacist needs to be able to locate and obtain it. To do this he needs to know the:

FIGURE A
A SYSTEMS MODEL



* Optional (non-prescription drugs).

- a) availability of the drug (manufacturer, name, address)
- b) price
- c) dosage
- d) proper storage conditions
- e) bioequivalence of products

The drug producing and distributing system is presented in the model (Figure A) as being simple and cogent. In reality, this is composed of a plethora of dissimilar and independent manufacturers who distribute their goods via multiple, redundant, and parallel distribution channels. A significant amount of information (a-e above) is needed to cope with this aspect of the pharmacist's role. As drug distribution systems become more and more mechanized, pharmacists are free to be involved in clinical practice. In this new role, the pharmacist needs to have available the following types of information:

- f) pharmacology
- g) pharmacokinetics
- h) drug name synonyms
- i) factors indicating a need for dosage modification
- j) indications
- k) contraindications
- l) drug interactions
- m) toxicology
- n) product data
- o) medical terminology
- p) basic medical physiology
- q) units of measurement
- r) drug information retrieval
- s) drug therapy monitoring for safety and efficacy
- t) drug literature evaluation
- u) proper design of research studies about drugs
- v) knowledge of colleagues' expertise (i.e., who is the best local expert)
- w) knowledge of patients' information needs
- x) to communicate drug information to the patient

It may be noted that several of the last needs mentioned are more appropriate to education or continuing education institutions. For example, all of the statements from "r" through "x" above are addressed by competency statements as published by Curriculum Improvement Office of the University of Minnesota College of Pharmacy.¹¹

2. Physician

The physician in the model (Figure A) is pictured as requiring or having prescribing capability before making the decision to prescribe. The system requires that he know the following to have this capability:

- a) official and trademark names of the drug
- b) conditions in which the drug is useful
- c) drug action in the body
- d) reasonable therapeutic endpoint (goal)

- e) contraindications
- f) usual dosage range
- g) route of administration
- h) proper duration of treatment
- i) adverse reactions
- j) drug interactions
- k) dosage modifications
- l) approximate cost of therapeutic regimen
- m) stability and storage of the drug
- n) formulation characteristics (e.g., dye content) of the product
- o) toxic doses and overdose management
- p) best drug to use based on specifics of patient's condition

3. Patient (Lay Public, Outpatients, Public Health Nurse, etc.)

Once the physician makes the decision to prescribe, it is the patient's turn to decide whether or not to purchase and/or consume the drug. Nurses may also act on behalf of the patient in the community (public health) or outpatient settings.

The patient needs to know:

- a) what will the drug do, what will it cost, and will it be effective
- b) how safe is the drug
- c) how and when the drug should be used and for how long
- d) what side effects are to be expected
- e) what symptoms or effects are a cause for alarm
- f) what things to avoid (activities, foods, drugs) while taking the drug prescribed
- g) how and where to store the drug properly
- h) how long to keep the drug
- i) how they are going to be monitored during therapy
- j) how to find out more information about the therapy
- k) what type of drug it is
- l) what the drug looks like

4. Nurse

The nurse's input becomes apparent when the patient enters an organized health care setting. In the hospital situation, the decision to purchase or consume a prescribed drug will be made by the physician on the patient's behalf. The nurse assumes the responsibility for at least storing the drug prescribed and, in most cases, routinely assumes the responsibility of drug administration. Consistent with the bedside care of the patient, a nurse needs to know:

- a) name of the drug
- b) proper administration information (route, rate, compatibilities, etc.)

- c) expected drug action in the patient (drug effect on signs and symptoms, physical findings)
- d) side effects expected
- e) signs and symptoms of serious adverse reactions (to decide to notify the physician or withhold doses)
- f) activities the patient must avoid while taking the drug
- g) proper storage conditions for the drug
- h) information to educate the patient about the drug
- i) mechanism of action of the drug

5. Other Health Care Professionals

Dietitians, dentists, physical therapists, respiratory therapists, radiologists, health care administrators, social workers, laboratory personnel, and others have occasional needs for drug information of a limited and specific nature. Each of these specific subsets of drug information are covered within the needs of others identified above.

6. Task Force Charge

The Task Force was charged with, "identifying the present and future information needs of the University of Minnesota Hospitals staff and patients, College of Pharmacy faculty and students and the (Minnesota) Community Health Care) Professionals and Laymen". Table 4 identifies how the groups implied in this specific charge are related to the general professional groups mentioned above.

C. Summary

Based upon a review of the sparse literature available pertinent to the question of what type of information is needed by health care practitioners, the Task Force has outlined a list of such information. The Task Force recommends that a survey be performed in the near future to support the premise that this list actually represents the needs of health care practitioners as they recognize them. The list of needs presented above will be used to design and define the scope of a system for their provision. The Task Force further recommends that the system to be presented in Part III be modified according to the results of the survey recommended above.

III. SYSTEMS FOR THE PROVISION OF DRUG INFORMATION

A. Introduction

This section of the Task Force report considers methods by which the foregoing needs can be met. The approach taken was: 1) to determine criteria of the system desired; 2) to evaluate the ways in which these criteria are being met presently by others; 3) to formulate a new system; and 4) to estimate the resources necessary to operate the proposed system.

B. Criteria

To insure that the criteria for measuring the system discussed are appropriate, it is usually best to state concisely the problem which the system is intended to solve; then to refer back to and modify the problem statement as necessary. The statement of the problem is:

"To provide information about any drug to any person in Minnesota in time to allow them to use the information in the prevention, diagnosis or treatment of disease."

Nine criteria which have been described by Cornell¹² are:

- 1) omniscient--provides all current information
- 2) omnipresent--is readily accessible anywhere
- 3) rapid--gives the answer quickly
- 4) flexible--gives the information at the level of the user
- 5) inexpensive--is affordable by the user
- 6) concise--provides only the information desired
- 7) simple--requires little training to use
- 8) credible--able to convince the user that the information is correct
- 9) unbiased--reports information objectively

The Task Force has informally surveyed users of the University of Minnesota Hospitals Drug Information Center and found the following criteria to be important:

1. Teaching

Under optimal conditions, the Drug Information System facilitates teaching in two ways. Students and practitioners learn methods and techniques of drug information retrieval and evaluation; the user of the system learns useful information each time the system and the user interact. Ruger recently documented the lack of understanding of basic concepts of information science.¹⁹ The need for the profession to develop persons with an understanding of these concepts was documented in the report of the Millis Commission.³ Specific teaching duties under each of the teaching roles are listed below.

a) College of Pharmacy

- 1) Teach interns, externs, Pharm.D. students, hospital pharmacy residents, and others how to retrieve and evaluate drug literature.
- 2) Teach the same group techniques in drug information services (e.g., how to question a questioner to obtain the information needed to answer his question).

b) Users

- 1) Teach its users how to make optimal and efficient use of the services provided by the drug information system.
- 2) Provide answers to questions which have as their origin and intent continuing education in health sciences.
- 3) Provide current interest searches for most of its users, thus keeping them up to date on information pertinent to their practice.
- 4) Publish a high quality bulletin which evaluates major new drugs introduced to the market and provides appropriate references.
- 5) Publish columns in local journals (e.g., Minnesota Medicine, Minnesota Pharmacist, Minnesota Nursing) in which the difficult questions are published with timely, concise answers.
- 6) Respond to the Continuing Education Programs in the Health Sciences by identifying areas of need for continuing education based upon questions received from practitioners.

2. Research

Two primary, of many, areas of research were identified by the Task Force. The first area, information science research, implies a systematic study of the characteristics of information and how it is to be transferred or handled, as well as the impact of information on the user.

The second area, research services, is the collaborative approach to performing research.

Both areas of research are restated in outline form below:

a) Information Science Research

- 1) study the relationship of information use and user behavior
- 2) study the effects of information use on the ultimate user (patient) behavior
- 3) study the impact on ultimate user (patient) when information is used by intermediaries (health care team)

b) Research Services

- 1) identify areas of research needed based on unanswerable questions posed to drug information staff
- 2) collaborate these research areas with the Assistant Dean for Graduate Studies and Research (College of Pharmacy) to facilitate planning and development of research projects and programs

3. Service

Numerous general recommendations about the nature of services performed were identified; they are summarized below. The System should:

- a) Be accessible 24 hours a day
- b) Serve as a resource to other College of Pharmacy information services
- c) Share its data bases with others at reproduction costs
- d) Have a firm and viable relationship with other College of Pharmacy information centers
- e) Be accessible from anywhere in Minnesota
- f) Require a maximum of eight hours to answer most questions
- g) Provide typewritten letters and/or photocopies of cited documents upon request
- h) Provide comprehensive literature searching including:
 - 1) all available current references
 - 2) very old references
 - 3) very new references
 - 4) very unusual references
 - 5) esoteric references
- i) Provide referral to local experts as needed by users
- j) Provide formulary monographs very soon after drugs are introduced to the market for use in Pharmacy and Therapeutics Committee meetings by users
- k) Retain in a retrievable format most of the questions it receives so as to expedite subsequent answers
- l) Provide full service to every user (requestor) in the state of Minnesota, including students, except in situation where students are working on school projects, in which case they would be referred to an appropriate source to assist them in searching for the information needed
- m) Retain records of services performed so that the System can be retrospectively evaluated
- n) Participate in an advisory committee which coordinates and reviews all of the College of Pharmacy supported information services
- o) Channel information through the local pharmacist whenever possible to further attempt to individualize the service

C. Review of Operational Systems

There are two basic system types available to find the answer to a question. There are interactive and non-interactive systems. Interactive systems provide the answer to a user's question directly and may include an educated guess (professional opinion) in the form of a recommendation. Examples to be discussed below are: Colleague Consultation, Academic Libraries, Pharmaceutical Manufacturers, Drug Information Centers, and the Food and Drug Administration. Non-interactive systems require the user to find their own answer or to make their own educated guess. Examples of non-interactive systems to be discussed below are: Indexing Services, Text and Reference Books, Periodical Publications, Current Interest Profilers, Document Delivery Systems and Advertisement. A statement which assists in clarifying the relationship between interactive and non-interactive systems is, "Interactive systems commonly make use of several non-interactive systems to provide services".

Each system type listed above is presented below in narrative summary and is described using a macro-flow chart to summarize multiple actions. Tables 5A and 5B are comparisons of the eleven (11) operational systems discussed according to the criteria of Cornell.¹² The second column in these tables present the type of data which, if available, would allow objective characterization of each system type. The Task Force felt it unwise to compare each system according to all of the criteria presented thus far (i.e., all of the criteria mentioned by the users).

1. Academic Libraries

Figure 1 is a macro-flow chart of information flow and user access in a traditional academic library. A primary user access point is by walking into the library. Some innovative academic libraries are now offering services with access via telephone or Teletype (TWX), but these are not traditional academic library services by definition. It is assumed that the user knows how to use the academic library. If the user does not, a librarian is available to teach the user how to formulate and perform the search and how to locate materials. Many libraries offer short courses in how to locate information. Unfortunately, few, if any, teach evaluation of the information discovered.

Information flow is mainly via textual and periodical literature. The materials are subscribed to or purchased by the library, catalogued, indexed and placed in an orderly fashion on shelves throughout the library. When a library

does not have a particular document, it may obtain it on loan from an affiliate.

If the user does not find the answer the first time through, he may, 1) make an educated guess at the answer; 2) change his search terms; or 3) give up, assuming the answer to be unavailable. The librarian may be consulted for advice. Traditional academic libraries have the most comprehensive data bases available. With the exception of subsidies from public taxes, use is free unless certain optional services are selected (e.g., computer searching). However, use can be time-consuming. The health care professional must travel to the library, must possess the knowledge required to use the system effectively, and may have to consult several documents before finding the desired answer. Librarians and information scientists are working on solutions to these problems.

2. Colleague Consultation

Figure 2 is a macro-flow chart of information flow and user access to the colleague consultation type of system. User access is most common via an informal system of public reputation and referral to consultants. The "Medical Information System Via Telephone (MIST)"¹³ in Alabama is a formalized, centralized service in which consultants register areas of expertise with a referral center which then refers user calls from throughout the state to appropriate experts.

User access is by telephone or person-to-person contact. The user asks the question and explains the circumstances as necessary. A user may receive the desired answer, a professional opinion, a further referral, or no answer.

Information flow is unique in this system. The consultant remains current with the literature in an area of expertise by subscribing to and reading appropriate journals and by purchasing textual and reference materials. The consultant does research and therefore remembers the results. Most uniquely, the consultant has access to his clinical experience from which impressions are derived. These impressions have not been subjected to scientific analysis and have a potential for bias. In the absence of scientific studies, these impressions form an admirable basis for professional opinion but are not an adequate substitute for scientific research and data reporting.

This system provides the specific answer desired without excessive information. It is fast since human memory is usually fast. A consultant develops a good reputation and gains subjective credibility. The data base

available is comprehensive and includes unpublished information. However, this system relies largely upon human memory which is sometimes faulty and always subject to bias. It relies upon uncontrolled clinical experiences which may be biased. Consultants rarely provide references to support the advice and thus, by definition, do not possess objective credibility. Unfortunately, the user may or may not know when the consultant is rendering an opinion. The need to establish a good reputation places the consultant under pressure to always provide an appropriate answer.

Colleague consultation is one of the oldest and well established systems. The factors discussed indicate that it is fast and concise, has subjective credibility and is relatively all-knowing. However, its reliance on human memory and uncontrolled experiences, and the pressure placed upon the consultant to provide an answer each time, subjects this system to bias.

3. Pharmaceutical Manufacturers

Figure 3 is a macro-flow chart of information flow and user access through the pharmaceutical manufacturer. User access is via telephone, mail or the local representative of the firm. The user asks the question and explains the circumstances as necessary. The manufacturer provides an answer if, 1) it may do so legally; 2) it wants to; and 3) it has the answer.

Information flow derives from research studies performed by the manufacturer. Some studies are never published and the manufacturer is the only source of this information. Other information is obtained by manufacturers who collect documents published independently. The documents are indexed and filed. Some manufacturers have a central file to which inquiries are directed. Others allow a "product manager" for each drug to store and index the information about that drug in his own file. When a question is received, it is referred to the central information office or to the specific product manager's office. If a decision to answer the question is made, the appropriate person searches the index and documents to locate the answer. Many firms use computers as an aid in this process.

Pharmaceutical manufacturers have access to large amounts of unpublished information (the bulk of the knowledge about the drugs they market). A manufacturer is usually considered an expert on the drugs it markets (subjective credibility). It also provides reference citations when requested (objective

credibility). However, the Food and Drug Administration places restrictions on the manufacturer, and, even when an answer is available, it may be withheld if the manufacturer feels release of information will result in financial harm. Pharmaceutical manufacturers may or may not answer quickly. An untrained user often will not know how to contact the manufacturer. To do so may involve a long distance telephone call and several transfers from person to person within the manufacturer's offices. Access is not facilitated significantly by many manufacturers.

Pharmaceutical manufacturers are relatively all-knowing about the drugs they market and possess both objective and subjective credibility. However, they are restricted in what information is given by federal regulations and a desire to remain in business. Therefore, little is done to facilitate access of health care professionals or the public to their information systems. Changes are needed in the federal regulations governing pharmaceutical manufacturers to allow and/or force them to release more of the available information. Pharmaceutical manufacturers should be encouraged to improve access of health care professionals and lay public to their information systems.

4. Drug Information Centers

Figure 4 is a macro-flow chart of the information flow and user access via intermediaries in a typical drug information center. There are approximately eighty-six (86) drug information centers in the United States at present.¹⁴ User access to a typical center is by telephone, mail or in person. The user presents the question and explains the circumstances as necessary. The user may receive the desired answer, a professional opinion, a further referral, or no answer.

Information flow is primarily via the published literature. Drug information centers subscribe to multiple indexing services and periodicals. They have on-going text and reference book purchasing systems. When the intermediary has received and clarified the question and the answer is not readily available, he or she formulates search terms and a search strategy. Textbooks and indexes are searched, cited materials located and read. If the answer is found, it is reported to the user. If the answer remains unavailable, the intermediary reaches a decision as to whether or not to form a professional opinion. If the decision is reached to form such an opinion, it is presented to the user as an opinion. If not, the intermediary searches the referral file for an expert referral. If none is available, the user is given no answer.

Drug information centers are relatively all-knowing by making use of multiple indexing services, periodicals, references and textbooks. They provide only the information desired. They are subjectively credible and will, upon request, provide references to support the answer given. Access is facilitated by many centers via well-publicized WATS lines or ordinary telephone numbers over which collect calls are accepted. Drug information centers have no reason to bias their answers and rely on human memory to a limited extent. At present, there is usually no direct charge to the user of these services. No special knowledge is required for the user to access the DIC and lay persons have access to the system. However, drug information centers rely heavily upon published literature. The inherent lag time in this system is discussed below. In order to improve omniscience, drug information centers need to devise systems to access the most current information, possibly before it is published. Drug information centers are not as fast as human memory and require improved automated systems to approach this standard.

Drug information centers come the closest to meeting all of the criteria described of any system discussed thus far. Drug information centers need to improve currentness of information and speed in providing answers.

5. Food and Drug Administration

Figure 5 is macro-flow chart of information flow and user access to information via intermediaries in the Food and Drug Administration information system. The FDA receives detailed information from pharmaceutical manufacturers as a requirement of investigational new drug applications. The manner of and degree to which the FDA indexes and files this information is not immediately apparent to outsiders.

Users access the FDA by writing or calling a local office. The user gives the question and explains the circumstances as necessary. The user is not aware of what happens next. It is apparent to outsiders that local offices do not have access to a highly organized file of information held by the FDA. Responses to all but the most simple questions take several days. There has been less information withheld for reasons of confidentiality since enactment of the "Freedom of Information Act of 1975", but certain information (e.g., trade secrets) is still considered confidential and is never released.

6. Indexing Services

Indexing services are the first of the non-interactive systems to be discussed. Figure 6 is a macro-flow chart of a typical indexing service. Information is derived solely from the published literature. There are several indexing systems, such as ERIC, which index unpublished works, but these are atypical. The indexing service subscribes to or purchases the published document. Each indexing service defines a subject area in which it plans to review the literature. It will then define a list of terms (controlled index) which it will use to describe the literature in the field chosen. Occasionally, an indexing service will use free word indexing wherein any major words found in the literature document are used to describe the document. Numerous studies have been done to determine whether free word indexing or controlled indexing is better. The results are inconclusive and both forms are prevalent today.

Once the indexing service receives a document, a trained reviewer reads the document, notes the citation (title, author, volume, pages, etc.) and records all of the controlled or free word index terms which describe the information contained in the article. The records of all reviewers are compiled. Indexing services publish and distribute the index on paper, on microform, and via computer format. Some services do not distribute the entire collection; they simply place it in a large time sharing computer and allow users to access it from remote sites.

The user accesses the indexing service by going to a subscriber (usually a library). The user first translates the question into either controlled index or free word index terms. If it is a controlled index system, the user refers to a comprehensive alphabetical listing of terms to see if the terms he uses are in the system. In a free word index system, the user tries to think of synonyms for the terms chosen so that all of the information available will be located. If the index is on a computer, the user enters the terms and the system's search commands and the computer prints the citations filed under the terms specified. If the index is not on a computer, the user reads through the appropriate sections and notes the citations which are described by the terms he has chosen. The user then locates the documents cited. If the information desired is not found, the user has the options of reformulating his search terms and trying again, trying another index, or giving up.

Indexing systems are limited to the scope determined by the provider, but several are relatively all-knowing. However, the indexing systems are

intrinsically delayed by the lag time associated with publication of information, their primary source of information.¹⁵ Indexing systems are not accessible to health care professionals in health care areas. Access is usually through a larger library. Manually operated indexing systems are very slow. Computerized indexing systems can be relatively fast, but the user must still locate the documents cited in order to find the answer to a question. Indexing services provide large amounts of unnecessary information and give all of the information at the level of the writer, not at the level of the user. Indexing services are affordable only by larger libraries. Few individuals can afford to purchase the index. However, when available, there is usually no fee involved with its use. Indexing services require the user to know how to define appropriate search terms and how to look them up. Thus, the user requires training for effective use.

Indexing services are useful tools in the hands of trained information specialists. However, they should not be viewed as a potential mode for the solution to the problem as stated. Significant improvements are needed for this to occur.

7. Text and Reference Books

Figure 7 is a macro-flow chart of information flow and user access in the text and reference book system. The author(s) gain their information by directly doing research and/or reading the reports of others' research in journals and/or books. The author(s) assimilate the information and write all or part of a book which is then sent to a publisher. The author then revises what was written. The publisher edits and prints the book and advertises and sells it.

The user either purchases the book or borrows it from a library or other source. To derive information from the book, the user may either read it from cover to cover (textbook) or keep it in an accessible place and use the index to derive specific facts from it as needed (reference book).

Text and reference books are limited in the amount of information they can contain by the technology of paper, printing, and binding. They are also limited in currentness by the same technology. The elapsed time from the conception to the publication of a book may be between two to three years. No single book is all-knowing. Access to a book may be good if the book is small enough to be carried with one at all times. Otherwise, one has to go to where the book is kept, a distance which can vary significantly (e.g., traveling to a library is much further than traveling to the nearest nursing station). If one

chooses the correct book first and uses the index quickly and properly, the system is among the fastest available. However, if access is distant from the user and the user does not have prior knowledge of which book to use or how to use it, the system can be slow. Books give information at the level of a presupposed audience which may not be the level of the user. Price of books vary according to the value of content, aesthetic appearance, currentness, and other undefined factors. Depending upon how well a book is indexed or written, it may or may not provide a concise summary of the information desired. Most books follow a similar format, reducing the overall training required for use. Books may lack credibility when they do not cite useful references to support the information provided. However, in general, books are well referenced and are therefore subjectively credible. Books may be biased or unbiased depending upon the author and the manner in which they are written and published.

Books form the backbone of most collections of information. The more familiar with the book the user is, the more useful the book. Technology is a limiting factor in the usefulness of the book. Advances in technology should be applied to improving this situation.

8. Periodical Publications.

Figure 8 is a macro-flow chart of information flow and user access in the periodical publication system. Information flows from its ultimate source, human, animal, and/or invitro research or clinical experience, through the pen of the researcher and into the hands of the periodical publisher. Occasionally, a review is published by a person who may or may not have done the original research. After the author revises the document, it is sent to a printer and distributed to all the subscribers (libraries, indexers, and users).

If the user is a subscriber, he may or may not have time to read or skim documents as they are received. Some extraordinary individuals read and file every document received.¹⁶ This is unworkable for most ordinary health care professionals and lay persons. Also, it amounts to "reinventing the wheel" as it duplicates the efforts of indexing systems. Most health care professionals attempt to read and remember the significant information provided via the journals to which they subscribe. For most people, this is a losing battle. This system is limited by the nature and characteristics of human long-term memory. Whether or not the user is a subscriber, it is likely that he will need to travel to the library to use an index to find specific information needed from a journal article.

The periodical system is the most current general system of information transfer and as a system is the most all-knowing. However, lag times from conception to publication of between two and three years are not uncommon.¹⁵ Access to all but the most popular journals is limited to major libraries. The only practical way to use periodicals to locate specific information is through indexing systems. Speed of these systems has been discussed and is related to computer use. Periodicals tend to give information at the level of the writer, not the user. Prices of periodicals vary and are generally high. However, when using libraries, they are usually available free of charge. A user has to wade through large amounts of unneeded information to find the answer to a specific question. Significant training is needed for the knowledge necessary to locate information efficiently and to evaluate it once found. Objective credibility varies from journal to journal and is dependent upon the extent to which authors use (and referees demand) scientific methodology. Subjective credibility varies according to the training and attitudes of individuals viewing the system. Bias is inversely proportional to the degree of adherence to the scientific method by contributors to the journal.

The periodical publication system suffers from one major flaw. It is source oriented. The periodical publisher tends to publish what it perceives the readership wishes from among the documents presented for publication. This perception commonly does not correspond to the specific information required by the user. Indexing systems are an attempt to bridge this gap but are subject to the limitations previously described. It is unlikely that the system will be overhauled in the near future due to the financial interests which drive the present system (drug advertisement, etc.).

9. Current Interest Profilers

Figure 9 is a macro-flow chart of information flow and user access via current interest profiling systems. These systems rely on the published literature. The provider periodically creates an index of the current literature and automatically searches this index by terms previously defined by the user.

The user accesses the system by an inperson interview with a profiler. The profiler translates the user's interests into a series of terms. The user then periodically receives a listing of citations which fit the description of his interests.

Current interest profiling systems and indexing systems are identical with the exception that the former provides periodical lists of specific citations

to subscribers. The advantages and disadvantages of indexing systems are discussed previously.

10. Document Delivery Systems

Figure 10 is a macro-flow chart of information flow and user access in document delivery systems. Information is usually available only from published documents. Document delivery systems subscribe to periodicals and purchase text and reference books.

The user accesses the system when a citation of interest has been located. The user may telephone, mail or walk in a request, indicating the specific citation desired. The profiling system locates, reproduces and transmits a copy of the material cited to the user. Upon receipt of the document, the user reads it, and may or may not desire another document.

Document delivery systems are all-knowing in that almost any published document can be retrieved. They are as current as the user who must use indexing systems for retrieval. Access is readily accessible. Turnaround times of 48 to 72 hours are typical; some documents may take weeks to locate. Information is presented at the level of the writer of the document. Some systems are underwritten by taxpayers (e.g., Minitex); others (e.g., Phodel) charge the user a minimum plus a per page charge. Charges usually are less than a user would pay to do it himself. The documents usually contain more information than the user requires. The system is simple to use once the citation has been located. The credibility and degree of bias are that of the documents themselves.

11. Drug Advertisement

Figure 11 is a macro-flow chart of information flow and user access in the Drug Advertisement System. Information originates with human, animal, and/or in vitro studies or clinical experience. The information is summarized and evaluated by the FDA which will allow or disallow it to be printed. After the information is filtered through the system, it is recombined into an official package insert which accompanies each supply of the drug, every advertisement for the drug (including the Physician's Desk Reference¹⁸), and every brochure for the drug.

The user accesses this information on receipt of the drug or by searching the Physician's Desk Reference. Often these advertisements are presented to the user whether desired or not.

The Patient Package Insert (PPI) System, although not well developed at the present time, would work in a manner very similar to the Advertisement System. The major exception is that the PPI must be given to the patient every time the drug is dispensed. This has and will continue to create significant logistical problems in institutions (e.g., hospital pharmacies with unit dose systems). Another problem is that the PPI's published to date have not been adequately written at the level of the intended user (the patient).

12. Summary of Operational Systems

Tables 5A and 5B compare each operational system discussed according to the criteria described by Cornell.¹² The interactive systems, particularly drug information center systems, come the closest to meeting all of the criteria discussed in the previous section. The Task Force, therefore, recommends that the system to be implemented be based on the Drug Information Center concept and be modified to meet as many of the criteria as possible.

D. Proposed System - Drug Information Center

The general concept of the proposed Drug Information Center (hereinafter referred to as the DIC) is that it is invisible to the user and personal in its interface. By invisible, it is meant that the user will submit a question and receive an answer without necessarily knowing the processes by which an answer is found. Most interactive systems are invisible to some degree. By personal, it is meant that, whenever possible, an answer will be given person to person. For this reason, the system is conceived to be decentralized. Decentralization increases the interaction between a specific group of users and a specific individual provider. This promotes familiarity, improves communication and results in higher subjective credibility. The particular individual provider is more easily held accountable by the local user group and therefore is encouraged to be reliable.

Decentralization would be carried out by establishing a Regional Drug Information Center which will transmit highly processed information to local DIC's in hospitals and other institutions throughout the state. The processing of the information will render it easier to use by the local center, thereby increasing productivity of the local center personnel. The regional center would handle provision of services which are outside of the scope of the local center's personnel and channel the results through the local center.

The specific functions of the system will be described under three major headings: Research, Teaching, and Service.

1. Research

Research is carried out by the center in both information science and research services as discussed earlier. The center will be available for collaboration on research projects with basic science and clinical faculty. Unanswered questions will form the major list of potential research subjects. The list can be reviewed by faculty periodically to stimulate research interests. Representative research projects anticipated in information science and research services are presented in Table 7.

2. Teaching

The DIC will provide didactic instruction and clinical experience in drug information retrieval, evaluation, and communication to students of the University of Minnesota Hospitals and College of Pharmacy as well as affiliated institutions. Other teaching functions are mentioned below under services. In addition, the Task Force recommends that a variety of extended learning experiences (B.S., Pharm.D., graduate and post-graduate clerkships and residencies) be established in drug information systems.

3. Services

Selected services offered by the DIC are presented in Figures 12 and 12A through 12D. Each sub-system will be listed here and referenced to the appropriate figure.

- a) questions about drugs (Figure 12-A-1 and 2)
- b) current interest profile (Figure 12-B)
- c) newsletter (Figure 12-C)
- d) structured learning experiences (Figure 12-D)

E. Resources Needed to Operate the Proposed DIC

Three types of resources needed for the operation of the proposed DIC will be considered. These are: Personnel, Space and Location, and Equipment. In the context of this report, books, journals, indexing files, computer and supplies will be considered equipment. Prices and salaries are estimated at their 1978 level.

1. Personnel

Table 9-A identifies the number, type, qualifications and costs of personnel needed to staff a DIC accessible 24 hours a day. These are estimates for a system which will perform all of the functions described for the proposed DIC.

The Task Force recommends that time and motion studies be performed on the existing Drug Information Center. This data will be useful in projecting personnel requirements and in comparing the cost effectiveness of various system modifications. Furthermore, the Task Force recommends that part of the previously recommended survey be used to estimate the number of requests that health care professionals and lay persons expect to make to a DIC such as the one proposed. Table 10 contains some extrapolations of personnel time required for the main DIC using some approximations.

2. Equipment and Supplies

Equipment and supplies needed for the proposed system are presented in Table 9-B. Note that this table assumes that each DIC subcenter will be provided with equipment by the facility housing the center as a consideration for services rendered.

3. Space and Location

Table 9-C identifies the amounts and types of space required for the proposed Drug Information Center. Factors pertinent to its optimal location include:

- a) availability of proper lighting and environmental controls
- b) availability of communications network port
- c) distance to source of live experts in pharmacology and medicine
- d) distance to larger collections of medical and pharmaceutical references
- e) distance to equipment servicers (time delay in repair)
- f) availability of collaborators in research efforts (computer scientists, clinical scientists, etc.)
- g) distance to College of Pharmacy (student and faculty travel time and expense)
- h) visibility associated with the sponsoring facility
- i) availability of back-up personnel
- j) nature and esthetics of housing the DIC function (e.g., noise level of present DIC, quiet of most libraries, etc.)

The Task Force has examined potential sites for the DIC. Each is listed below with brief statements considered by the Task Force.

University of Minnesota Hospitals

- present DIC site
- certain equipment is already available
- suboptimal reputation
- space not allocated for regional DIC
- most pharmacy staff have experience in DIC operation
- funding already established from hospital budget
- centrally located for students
- availability of experienced drug information faculty

Hennepin County Medical Center

- 24 hour service - available via Poison Center
- two "drug" centers at the same site
- availability of clinical pharmacy practitioners
- space not allocated for DIC
- poison control personnel trained and experienced in information retrieval systems
- distant from large collection of reference work

St. Paul-Ramsey Medical Center

- 24 hour clinical pharmacy coverage available
- site of majority of clinical pharmacy education for College of Pharmacy
- availability of both dedicated and on-line computers
- space not allocated for DIC
- high visibility from medical staff and students

College of Pharmacy

(combined with Drug Information Service Center - DISC)

- central location for C.O.P. faculty
- availability of pharmacy faculty for research and/or consultation
- very centrally located for students
- potential space allocations in Unit F
- funding already established for DIC
- ability to "design" the physical plant for the DIC

Diehl Hall - Biomedical Library

- fifth floor (present Learning Resource Center Site, 1500 to a possibly 2500 sq. ft. available)
- available in two years, depending upon completion of construction of Unit B/C
- equal distance from hospital, other patient units and School of Pharmacy (after move to Unit F)
- convenient for students (especially after Pharmacy Library is integrated into Biomedical Library collection)
- easy access to comprehensive book and journal collection and large audiovisual center

- availability of librarians for consultation on search methods, collection development and organization
- large classroom (Room 555) available for student instruction
- highly visible to students who use Biomedical Library -- its regular collections, reserve readings and Learning Resource Center

The physical location of the regional Drug Information Center shall be determined by the availability of space. Strong consideration will be given to satisfying the criteria and building on the present assets of the previous sites reviewed by the Task Force.

F. Summary

Systems for the provision of the drug information needs of health care professionals were discussed. A preferred system (the Drug Information Center concept) was identified and the resources needed to establish and operate it were postulated. The Task Force recommends the following:

1. a mechanism be found to establish the proposed system
2. a time and motion study be performed on the existing system for analysis of system modifications and to foster sub-center development
3. adequate space in an optimal location be found for the proposed system
4. user demand be anticipated by surveying the intended users
5. resources to be provided by the site be considered in establishing the future site of the Drug Information Center

IV. SHORT AND LONG RANGE APPROACHES TO FUNDING A REGIONAL DRUG INFORMATION CENTER SYSTEM

A. Introduction

There are two kinds of funding needed for the proposed system: implementation (short range) funding and maintenance (long range) funding. This section of the report will examine the funding process and extrapolate that impact to the likely beneficiaries of the system.

B. Short Range Approaches

Short range approaches to funding for a DIC are usually one-time fixed

amount grants. These will be used solely for implementation and development costs. Experienced administrators (for example, federal, state, and local legislators) are most likely to appreciate the benefits of providing implementation and development funds. The Task Force recommends that federal, state, and local governments, and private foundations be approached to provide one-time grants for the development and implementation of a DIC.

C. Long Range Approaches

Long range approaches are arbitrarily defined as approaches which result in provision of upkeep and maintenance costs on an ongoing basis. They have no foreseeable or predictable endpoint. The mechanisms to be discussed are recurring grants, taxation, subscriptions, and contracts for services.

1. Recurring Grants

Recurring grants are the weakest form of long range funding. The Task Force recommends that recurring grants used for maintenance and upkeep be confirmed by contracts for not less than a five-year period, and that the DIC not be dependent upon such funds for a significant proportion of its resources. Agencies most likely to offer recurring grants include federal, state, and local governments, private foundations, major health insurance providers, and health maintenance organizations.

2. Taxation

One mechanism for the lay public to subsidize the provision of drug-related information is through taxation. In order to acquire tax revenues, the system must submit a request for a line item on the state's biennial budget, or the federal budget. Within the federal government, the National Library of Medicine would seem to be the best home for a DIC. To accomplish this, the Center must be affiliated with a major resource library, such as the Diehl Hall Biomedical Library at the University of Minnesota. The Task Force recommends such an affiliation. Within the state government, the Prevention Support System of the State Department of Public Welfare would seem most appropriate for the DIC. At the local level, county and city officials could establish the resources needed for DIC sub-centers.

3. Subscriptions

The most direct and equitable way for Center users to pay for the information received is on a fee-for-service basis. The mechanics of such a

system probably are unworkable on a large scale. It seems best to offer both individual and group subscriptions. Subscription price would vary according to the volume of service provided to the subscriber. Any individual or agency is eligible to subscribe (i.e., pharmacy chains, hospitals, health maintenance organizations, etc.). Subscriptions are responsive to the demand for services and are recurring by nature. Furthermore, they provide a direct mechanism for users to provide feedback to the system. The Task Force recommends that a substantial proportion of the funding for a center be sought from individual and group subscriptions.

4. Contract for Services

One-time needs for information services which are outside of the normal scope of the Center will undoubtedly occur. These can be accommodated by formalized contracts for services which are specific to the given needs of the requesting party. Careful analysis of the work to be done should be performed, and a firm estimate of cost be given to the requesting party. If this estimate is acceptable to both parties, a legally binding contract should be created by which the Center is reimbursed for all costs of providing the services.

D. Beneficiaries of the Drug Information Center System

The following groups discussed have a significant impact on the DIC as users and should be approached to provide long range funding.

1. Patients

Patients benefit from the ready availability of drug information in two ways. First, they benefit directly by knowing how to use drugs properly thus avoiding self-inflicted drug-induced diseases. Second, they benefit indirectly by the drug knowledge used by health care professionals in diagnosing and treating their disease. Drug knowledge is also used by health care professionals in preventing drug-induced diseases to the obvious benefit of the patient. Patients should pay directly and/or indirectly for the provision of drug-related information.

2. Health Care Professionals

Drug-related information forms an essential portion of the professional knowledge of the health care professional. A system which continuously updates and makes available drug-related information is beneficial to the health care professional. Health care professionals should pay at least part of the cost of the direct provision of accurate and unbiased drug-related information.

3. Federal, State, and Local Governments

Federal, state and local governments represent the interests of both the patient and the health care professional on several levels. Availability of drug-related information may reduce drug-related morbidity (e.g., by decreasing the incidence of adverse drug reactions). If the availability of information also results in a lower incidence of unnecessary drug therapy in patients, direct costs of drugs decrease.

The federal government presently recognizes its responsibility to provide medical information to the health care professional. The Medical Library Assistance Act of 1965 and subsequent congressional actions of the federal government established the biomedical communications network administered through the National Library of Medicine. A part of this program originally envisioned a series of "specialized information services" to provide answers to questions rather than the provision of traditional library services. The Task Force recognizes this commitment as a potential area of funding since these "specialized information services" have yet to be developed.

4. Pharmaceutical Manufacturers

Pharmaceutical manufacturers stand to benefit from the availability of drug-related information. If such availability promotes a more rational use of a drug marketed by a given firm, the experience of the medical community with that compound will be more favorable. Pharmaceutical manufacturers should subsidize, in part, the direct provision of drug-related information to health care professionals and the lay public.

5. Hospitals

Hospitals are expected to provide, according to Joint Commission on Accreditation of Hospitals (JCAH) standards, information about drugs to patients and staff (health care professionals).¹⁷ Ready access to drug-related information via a DIC would facilitate provision of this service. Hospitals should pay for information provided directly to their staffs and patients.

6. Health Maintenance Organizations

"Health Maintenance Organizations are authorized, in connection with the prescription of drugs, to maintain, review, and evaluate a drug use profile of its members receiving such service, evaluate patterns of drug utilization to assure optimum drug therapy, and provide for instruction of its members and of

health professionals in the use of prescription and non-prescription drugs."²¹
In order to attain this, HMO's will need to acquire drug-related information. Health Maintenance Organizations should pay directly for drug-related information provided to staff and patients.

7. Major Health Insurance Providers (e.g., Blue Cross)

Major health insurance providers are in a situation similar to that of health maintenance organizations. Cost containments are desirable in light of current economic and political trends. As discussed earlier, drug-related information could have a significant impact on major health insurance providers. These providers should pay directly for drug-related information provided to health care professionals and the lay public.

8. Community Pharmacists

Community pharmacies employ numerous pharmacists who, in the practice of their profession, must provide drug information to patients. A DIC could provide a source of such information to the professional staff of such pharmacies. Pharmacies should pay for the information provided to their staffs.

E. Summary and Recommendations on Funding

Agencies and groups of persons who stand to benefit from a DIC have been identified. Mechanisms for obtaining funding were proposed. The Task Force recommends the following:

1. a survey regarding the willingness of benefactors to pay for a DIC be performed, with the stipulation that benefits of such a system be succinctly explained at that time
2. that grants be sought for the implementation of the DIC
3. that the DIC seek legislative recognition and therefore be subsidized in part by federal, county, state, and/or local taxes
4. that the DIC not be dependent upon recurring or non-recurring grants for a significant proportion of its resources
5. that subscriptions form a significant proportion of the long range funding of the DIC

V. SUMMARY

The reader is directed to the Summary and Recommendations, pages i-iii of this report.

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TABLE 1

INFORMATION NEEDS OF RESEARCHERS, PHYSICIANS, NURSES, PHARMACISTS, AND PATIENTS

Adapted from Reilly, M.J., "Drug Information: Literature Review of Needs, Resources, and Services", U.S. Department of Health, Education and Welfare (Publication number 72-3010), 1972.

Research:

Documents, citations, abstracts, articles, literature search, patents

Physician:

Data-not documents; fast response; "any of the chemical or biological properties of a therapeutic or diagnostic agent including biopharmaceutic properties, toxicity, absorption, distribution, metabolic fate or excretion characteristics, effect on cellular metabolism, method of action, dosage, therapeutic effects, therapeutic incompatibilities, interactions with other drugs or interference with laboratory test values, stability, environmental and/or social effects, or price "; documents to promote rational therapeutics, to support research, and to aid on education"

Nurse:

Parallel to physician; "Relationship of prescribed drug to the total therapeutic goal"; information to assess desirable as well as undesirable effects of drugs on patients (alterations mediated by the drugs in the patient symptoms, his vital signs, his hour-by-hour behavior, and able to interpret laboratory reports); route of drug excretion; likelihood of a cumulative effect; importance of desirable blood levels; time interval to attain effective action; adverse reactions; incompatibility information; interaction information; relationship of food and fluid intake; factors that determine route of administration; enough about the drug to teach a patient how to use it.

Pharmacist:

Needs at time of dispensing prescription by a physician; commercial availability; price; dosage; information that physicians (and other HCP's) request from them; pharmaceuticals; formulation of trade name products; bioavailability; diverse as those of physician, parallel to those of physician; nonprescription drug information.

Patients:

Profound need for drug information; what drug he is taking; the effects it should produce; what signs indicate improvement or deterioration; storage requirements; how to take medication properly; benefits; limitations; hazards; directions for best use; side effects; possibility of interaction with foods or other drugs.

TABLE 2

RELATIVE IMPORTANCE OF VARIOUS TYPES OF INFORMATION TO NURSES

Anon. "The Nurse and Drugs Administered in Hospitals" American Journal Nursing 74:13-22, (June) 1974.

	<u>(Percentage of Respondents)</u>		
	<u>Vitally Important</u>	<u>Important</u>	<u>Not Important</u>
Dosage	90.0%	10.0%	0%
Side and/or toxic effects	81.3%	18.7%	.0%
Administration	77.1%	22.7%	0.2%
Interactions	63.3%	36.1%	0.6%
Dynamics of drug action	52.9%	45.3%	1.8%
Implications for patient teaching	28.1%	63.7%	8.2%

Table 3
Frequency of
Various Question
Type

	Michigan Regional Drug Information Network (1)	Nebraska Regional Medical Program Drug Information Service(2)	Valley Hospital Ridgewood, New Jersey(3)	Memorial Hospital Medical Center, Long Beach, Cal.(4)
Dosage	12.7%	5.0%	30.0%	15.0%
Therapeutic Use	10.1%	13.0%	16.0%	25.0%
Side Effect/ Contraindications	4.5%	4.6%	6.0%	26.0% (and toxicity)
Adverse Reactions	3.9%	2.4%	8.0%	-
Toxicity	4.1%	15.5%	5.0%	-
Availability	16.2%	18.8%	2.0%	8.0%
Therapeutic Compatibility	2.5%	3.9%	4.0%	5.0%
Pharmaceutical Compatibility	6.0%	3.9%	8.0%	4.0%
Identification	17.5%	16.0%	12.0%	10.0%
Metabolism	1.0%	.4%	1.0%	4.0% (Absorption, excretion)
Others	<u>21.2%</u> 99.7%	<u>16.3%</u> 99.8%	<u>6.0%</u> 98.0%	<u>2.5%</u> 99.5%
	(7,631 questions)	(953 questions)	(242 questions)	(2,819 questions)

1) Dept. Health, Education and Welfare: Drug Information Services: Two Operational Models, DHEW Publ. No. (HMS) 72-3030, pages 195-265.

2) Groth PE: Nebraska Regional Medical Program Drug Information Service, Cumulative Report for Iowa, 1972.

3) Rosenberg JM and Peritore SP: A Drug Information Service in a Community Hospital, Am J Hosp Pharm 28: 270-274 (Apr) 1971.

4) Schweigert BF: Drug Information Services on a Subscription Basis, Am J Hosp Pharm 33: 823-827 (Aug) 1976.

TABLE 4
TASK FORCE CHARGE

CHARGED TO DELINEATE NEEDS OF:

PERTINENT NEEDS SECTION:

1. University of Minnesota Hospital Staff	Physician, Pharmacist, Nurse, Other
2. University of Minnesota Hospital Patient	Patient
3. College of Pharmacy Faculty	Pharmacist*
4. College of Pharmacy Students	Pharmacist
5. Community Health Care Professional	Physician, Pharmacist, Nurse, Other
6. Community Laymen	Patient**

*Special need for very current information.

**Special need for better appreciation of their own need to know and how to find information about drugs.

Table 5A. Systems Evaluation - Interactive Systems

Feature	Data Type	Academic Library	Manufacturer	Colleague Consult	Traditional DIC
Omnipresent	distance to access	nearest library (can be far)	nearest telephone, occasionally representative comes to patron	nearest telephone, or travel to colleague's office	nearest pharmacy station or nearest telephone
	types of access mode	telephone (some libraries) walk in (most libraries) teletype in other libraries	telephone (long distance), district representative, or mail	mail, telephone, walk-in	telephone, mail, in person pharmacists in local centers
Omniscient	number of questions unanswered, (percentage)	few	variable	depends upon definition of unanswered - almost always get an answer of some type or another (i.e., is educated guess really an answer	contains almost all of the drug information printed by man, answers most questions asked, will make educated guesses, but qualifies them as educated guesses only
Fast	number of minutes or hours to answer	slow	slow	relatively fast (human memory recall)	fastest known (via computer use)- depends upon question type (see Table 2)
Flexible	user able to understand answer	yes (eventually)	yes	yes	yes
Inexpensive	cost of various question type	high (due to personnel required)	free service except for: 1) telephone charges 2) cost of subsidizing via drug prices	varies. usually free as a professional courtesy. when legally binding, usually a consultation fee is paid by patient	See proposed system resources discussion

Table 5A (continued)

Feature	Data Type	Academic Library	Manufacturer	Colleague Consult	Traditional DIC
Concise	(subjective) number of words to answer the question	rarely - user must cull information from large files.	variable - usually answer the specific question	usually answers the specific question, but variable	by definition, concisely answers all questions
Simple	(subjectively how easy is it to use the cen- ter) the num- ber of hours training someone to learn how to use	not simple. Ac- complished users need to learn multiple indexing and retrieval systems	easy if one knows how to locate the manufacturer- this can be taught in a few minutes	difficult - one must personally know most consultants. If one doesn't know all of the local "experts", it is hard to measure or find out who they are.	simple. One needs merely to ask the question
Credible	(subjective) the number of people who say they: never, always, or usu- ally believe the answer that they get	? High - tendency to deprecate book knowledge	High among certain groups (R.N., M.D.) low in others (Pharm D., RPH)	very high or the con- sult would never be made	unknown due to lack of present existence of a center
	Objectively - the number of times the answer		high	probably not as high (due to human memory flaws)	probably very high due to reliance on objectively correct sources of information.
Unbiased	very subjective. The amount and quantity of	very high- scientific research forms	very low - need to stay in business	low - i.e., they rarely cite research results	very high - they always answer on the basis of top quality research in- formation whenever avail- able. Whenever this is not available, the answer is qualified as the best guess

Table 5B Systems Evaluation - FDA and Non-Interactive Systems

Feature	FDA	Indexing Services	Text and Reference Books	Periodicals	Current Interests Profiling	Document Delivery	Drug Advertisement
Omnipresent	Telephone, mail or walk-in.	Walk to library	Depends upon size of book - walk to library or nearest source of book.	Primarily libraries.	Telephone - mail	Telephone-mail (telecopier)	Mail, journals, multimedia.
Omniscient	Perhaps the largest data base on drugs in world.	Depends upon scope of service.	Depends upon size of book and scope.	Depends upon scope of periodical.	Depends upon scope.	Can deliver almost any document; therefore relatively omniscient.	Lacks comprehensive presentation of information.
Fast	Turnaround time several days to a week.	Depends upon expertise of user - usually several hours for most searches.	Depends upon expertise of user - relatively fast.	Relatively slow, depends upon expertise of user.	Not Applicable.	Turnaround too slow for typical use in medical decision-making.	Not applicable.
Flexible	Usually at user's level	Information usually at writer's, not user's level.	Information at level of writer.	Information at level of writer.	Information at level of writer.	Information at level of writer.	Information at variable levels, usually at user level.
Inexpensive	Free - subsidized by federal income taxes.	Use is Free but relatively expensive to library budgets - subsidized by public funding.	Relatively expensive - may be used free in many instances.	Relatively expensive - may be borrowed and used free in many instances.	Relatively expensive (\$200-\$300/yr. typically for one user).	Relatively expensive given the technology currently used.	Free to user but subsidized through cost of medications - paid by patients

Table 5B (continued)

Feature	FDA	Indexing Services	Text and Reference Books	Periodicals	Current Interests Profiling	Document Delivery	Drug Advertisement
Concise	Relatively concise	User must read numerous unnecessary publications before finding answer.	Depends upon expertise of writer and editor.	User must read numerous unnecessary publications before finding answer.	Relatively concise, but user occasionally receives unnecessary documents.	As concise as documents delivered.	Not applicable.
Simple	User needs only ask question.	User requires significant amount of training to use efficiently.	Training necessary but due to similar format of most textbooks, training time is reduced.	Requires indexing service to use efficiently. This requires significant training.	Relatively simple to use.	Simple to use.	Simple to use but person should be taught how to evaluate.
Credible	High	High	Mediocre	High	High	High	Mediocre to low.
Unbiased	High	High	High	High	High	High	Extremely low.

Table 6
A Comparison of the Proposed System with all Criteria
Identified by the Task Force

<u>Criteria</u>	<u>Comments</u>
1. Omniscience	By subscribing to large numbers of data bases and textbooks, the system becomes relatively omniscient.
2. Omnipresence	Access is from any point in the state via toll-free telephone or local telephone numbers. In most instances, information can be given to the user in person due to decentralization.
3. Speed	Depends upon the degree of implementation of computerized services. Relatively fast compared to academic library use, especially if the user would have to travel far to reach an academic library.
4. Flexibility	The information is always provided at the level of the user.
5. Inexpensiveness	Remains to be determined; probably is more cost effective than for the user to perform their own searches due to centralization and training of the personnel.
6. Conciseness	All answers provided by the center will be as concise as possible.
7. Simpleness	Extremely simple to use. The user simply asks the question and receives the answer in the format chosen.
8. Credibility	Subjective credibility will depend upon the experience the users have with the system. Objective credibility will be very high due to heavy reliance upon scientifically evaluated literature.
9. Unbiasedness	High - due to heavy reliance upon unbiased scientific studies.

Table 7

Projects in Information Science and Research Services

I. Information Science Research

- A. Study the relationship of information use and user behavior.
- B. Study the effects of information use on the ultimate user (patient) behavior.
- C. Study the impact on ultimate user (patient) when information is used by intermediaries (health care team).

II. Research Services

- A. Identify areas of research needed based on unanswerable questions posed to drug information staff.
- B. Collaborate these research areas with the Assistant Dean for Graduate Studies and Research (College of Pharmacy) to facilitate planning and development of research projects and programs.

Table 8

Summary of a Comprehensive Drug Information Database*

100 *	Names
200 *	Physical Properties
300 *	Uses and Pharmacology
400 *	Contraindications
500 *	Adverse Drug Reactions
600 *	Pharmacokinetics and Biopharmaceutics
700 *	Dosage
800 *	Drug Interactions
900 *	Toxicology
1000 *	Product Data
1100 *	General Information
1200 *	Miscellaneous Information

* Complete database description available from Cornell.

TABLE 9A - (Personnel) 1978 DRUG INFORMATION CENTER COSTS (Estimates Only)

Title	Base Salary	Fringe (18%)	FTE	Total	Qualifications
Director	23,000	4,140	1	27,140	Advanced Professional Degree. Assistant Professor eligibility, Experience, Registered Pharmacist
Assistant Director	20,000	2,600	1	23,600	Advanced Professional Degree. Assistant Professor eligibility, Experience, Registered Pharmacist
Librarian	12,000	2,160	1	14,160	Training in Librarianship
Pharmacist, Regional DIC 18,000	18,000	3,240	4	84,960	Registered Pharmacist, (Advanced Degree and training favorable but not required.)
Secretary	8,000	1,440	2	18,880	Typing and secretarial skills
DIC Clerk	8,000	1,440	2	18,880	On job training
Pharmacist Subcenter	18,000	3,240	10*	212,440	Advanced Degree, Registered Pharmacist. On job training.

Total *needed only after system fully developed
(i.e. after 1978)

16 FTE Rph
4 FTE Technical
1 FTE Librarian

Estimated Personnel Budget
\$400,020

Table 9-B
Equipment (Estimates Only)

	Unit Cost	# Required	Total Cost	Yearly Upkeep Not Performed by Personnel
1. Furniture				
Desk	350	7	2,450	0
Table	300	1	300	0
Chair	100	108	1,800	0
Study	300	4	1,200	0
2. Filing Equipment				
File Cabinets	300	8	2,400	0
Bookshelves	150	10	1,500	0
Desk Accessories	50	9	450	0
3. Information Containing Equipment and Supplies				
Books	n/a	n/a	1,550	300
Journals	n/a	n/a	750	500
IDIS	n/a	n/a	4,500	900
IDIS Tape	n/a	n/a	600	600
IPA on Tape	n/a	n/a	2,000	600
Drug Dex	n/a	n/a	1,800	1,800
Poisindex	n/a	n/a	1,800	1,800
Bibliographic Retrieval Services + NLM	15.00/hr	200 hrs.	3,000	3,000
4. Information Retrieval Equipment				
Microfilm Reader	200	3	600	50
5. Communications Equipment				
Telephone	50	8	400	200
Watts Line	250/mo	1	3,000	3,000
Long Distance Charges	20/mo	12 mos.	240	240
Typewriter	650	2	1,300	156
Typewriter Ribbon	2	20	40	40
Paper and Envelopes	.10	2000	200	200
Pencils and Pens	.25	200	50	50
Xeroxing & Printing	.05	20,000	1,000	1,000
Modem	300	1	300	36
6. Record Keeping Supplies				
Time Stamp	250	1	250	0
Log. Forms	.01	15,000	150	150
Total Equipment Cost and Upkeep				
		56	33,630	14,622

Table 9-C

Space Needs (Estimates Only)

Room Name	Number Square Feet
Director's Office	1 @ 120 sq. ft.
Pharmacist's Office	2 @ 120 sq. ft. = 240 sq. ft.
Work Area	1 @ 600 sq. ft.
Conference Room	1 @ 120 sq. ft.
Student Room	1 @ 120 sq. ft.
Sub-center Work Area	(10@ 50 to 100 sq. ft.)
Total	1200 square feet

Table 10 - Cost Projections Main DIC

System	# Short Answers (15 min) #FTE	# Medium Duration Answers (30 min) #FTE	# Consulta- tions (5 hr) #FTE	#Education Requests (20 min) #FTE	#Personnel Trained (6 hr) #FTE	# Drug Reviews (15 hr) #FTE	# Bulletins Published 27.4 hr #FTE	#Inservice Lectures (4 hr) #FTE	#Expert Referrals (15 min) #FTE	# Hrs. Clinical Research 20% Total #FTE	TOTAL #FTE
1. Current DIC*	$\frac{4190}{.595}$	$\frac{462}{.13}$	$\frac{90}{.26}$	$\frac{400}{.08}$	$\frac{25}{.09}$	$\frac{10}{.09}$	$\frac{9}{.14}$	$\frac{30}{.07}$	$\frac{400}{.06}$	$\frac{0}{.427}$	$\frac{N/A}{2.66}$
2. Minimal increase in service (1.5x)	$\frac{6000}{.85}$	$\frac{600}{.17}$	$\frac{135}{.38}$	$\frac{600}{.11}$	$\frac{38}{.13}$	$\frac{50}{.43}$	$\frac{12}{.19}$	$\frac{45}{.10}$	$\frac{600}{.09}$	$\frac{900}{.46}$	$\frac{N/A}{2.91}$
3. Moderate increase in service (2.5x)	$\frac{10000}{1.42}$	$\frac{1000}{.28}$	$\frac{225}{.64}$	$\frac{1000}{.19}$	$\frac{63}{.21}$	$\frac{75}{.64}$	$\frac{12}{.19}$	$\frac{75}{.17}$	$\frac{1000}{.14}$	$\frac{1500}{.75}$	$\frac{N/A}{4.62}$
4. Large increase in service (5.0x)	$\frac{20000}{2.84}$	$\frac{2000}{.57}$	$\frac{450}{1.28}$	$\frac{2000}{.38}$	$\frac{125}{.43}$	$\frac{75}{.64}$	$\frac{12}{.19}$	$\frac{150}{.34}$	$\frac{2000}{.28}$	$\frac{3000}{1.63}$	$\frac{N/A}{8.31}$
5. Outside high expec- tations of demand (10.0x)	$\frac{40000}{5.68}$	$\frac{4000}{1.14}$	$\frac{900}{2.6}$	$\frac{4000}{.76}$	$\frac{250}{.85}$	$\frac{100}{.85}$	$\frac{12}{.19}$	$\frac{300}{.68}$	$\frac{4000}{.57}$	$\frac{6000}{2.63}$	$\frac{N/A}{15.94}$

* Figures for Fiscal Year 1976-77.

** Does not consider time spend in administration or fatigue time other than vacation time.
College of Pharmacy faculty activities also not included.

Information Flow

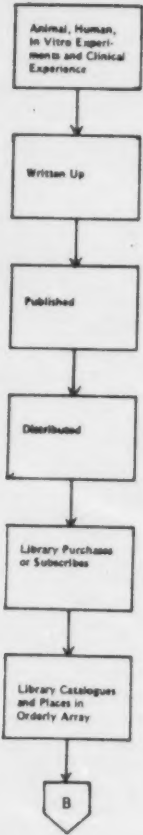


FIGURE 1 - ACADEMIC LIBRARY SYSTEM

User Access

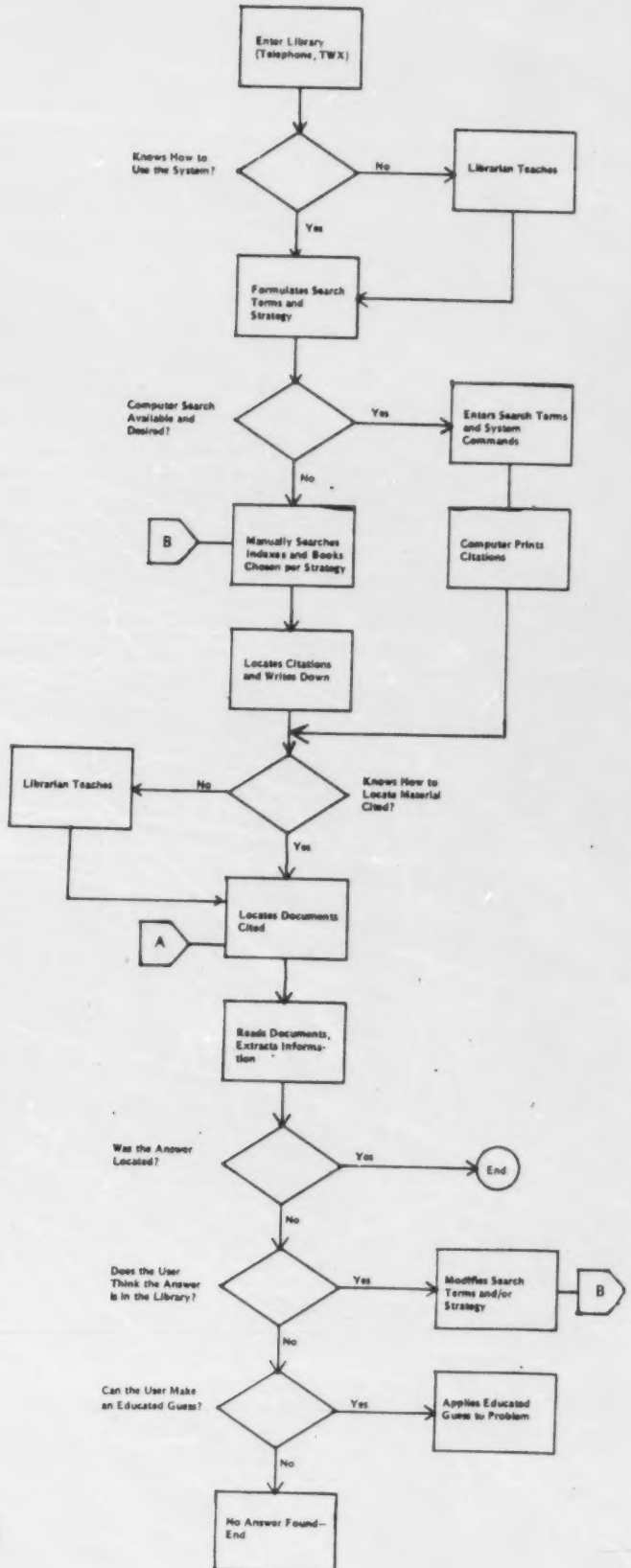


FIGURE 2 - COLLEAGUE CONSULTATION SYSTEM

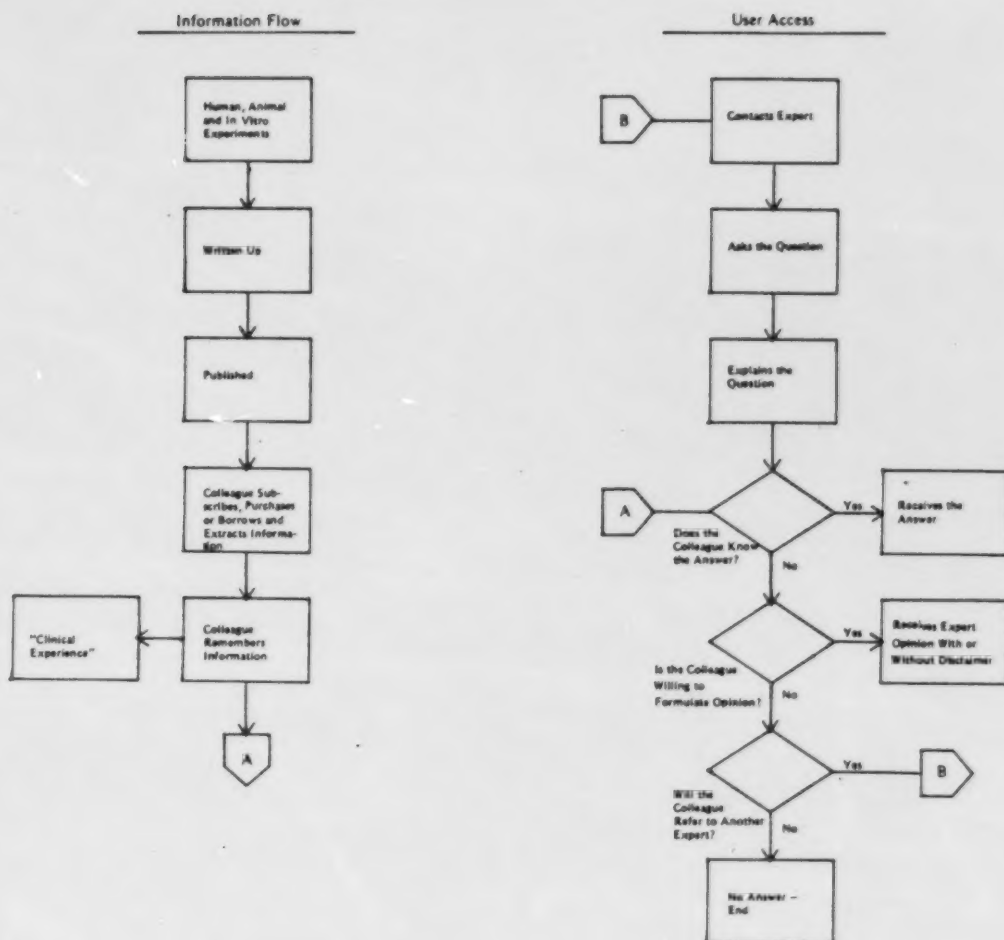


FIGURE 3 - PHARMACEUTICAL MANUFACTURER SYSTEM

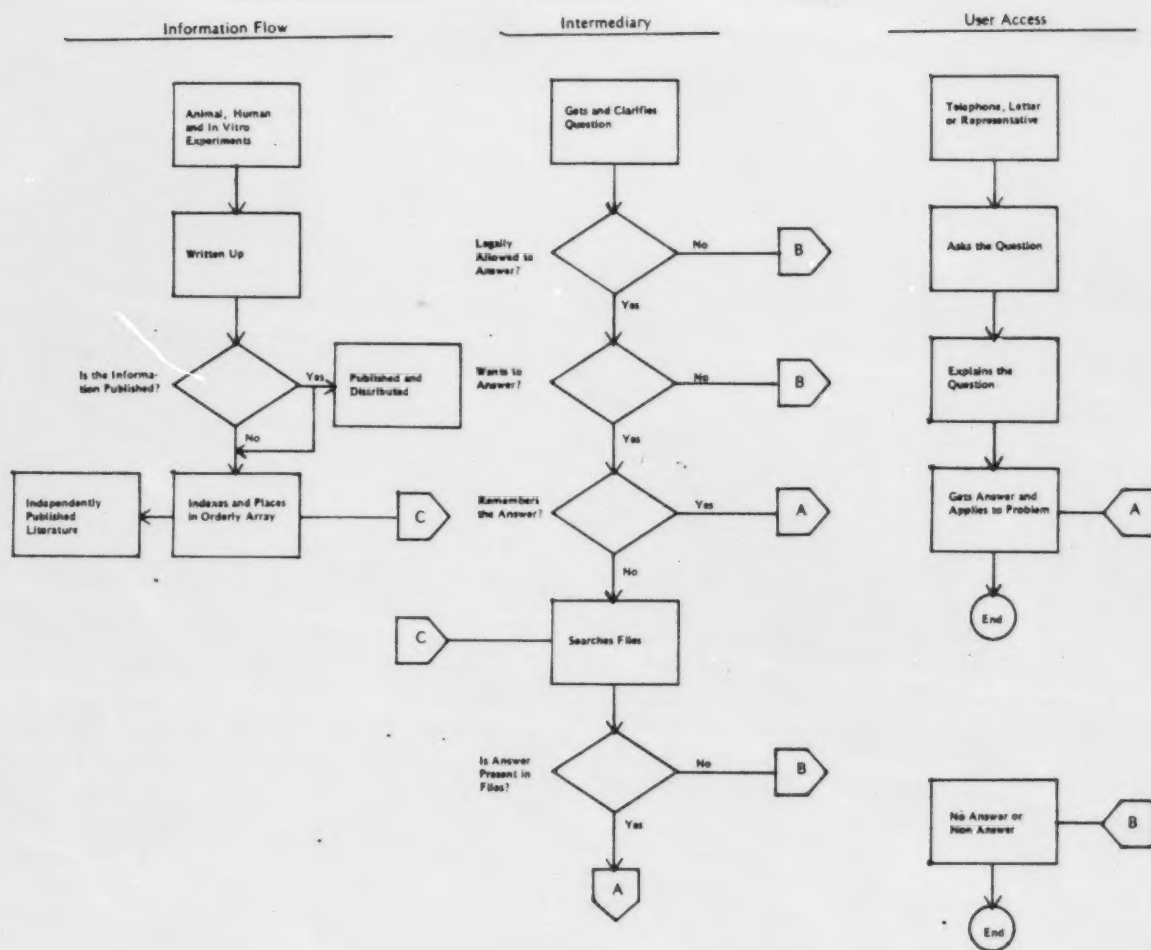


FIGURE 4 - DRUG INFORMATION CENTER SYSTEM

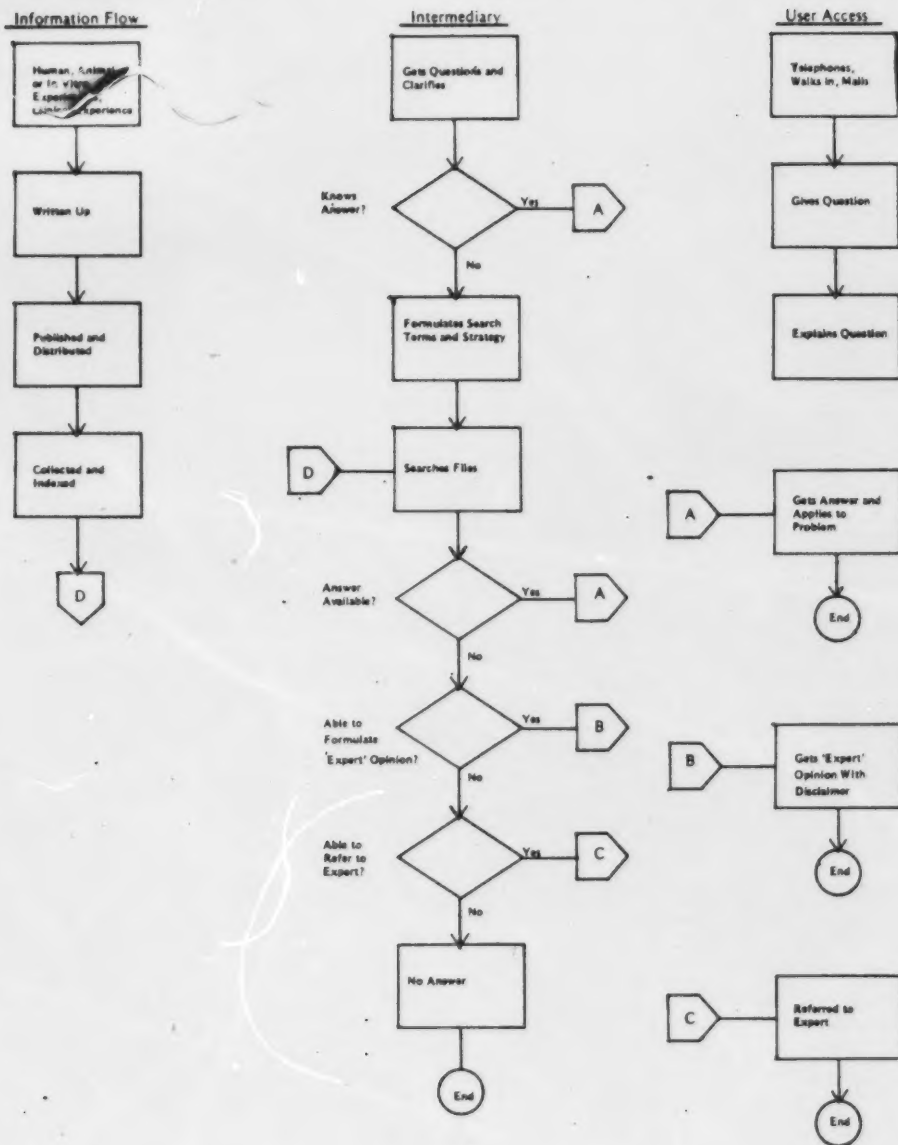


FIGURE 5 - FOOD AND DRUG ADMINISTRATION SYSTEM

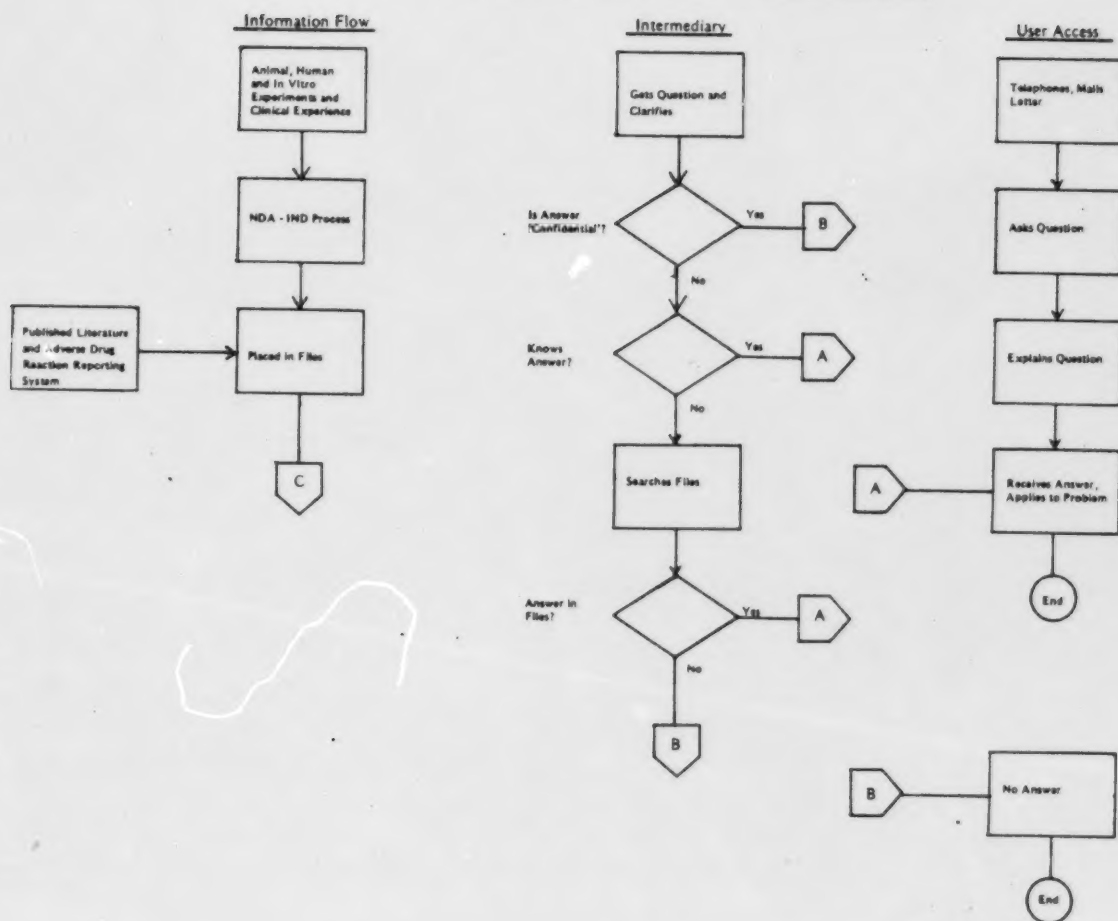


FIGURE 6 - INDEXING SERVICES

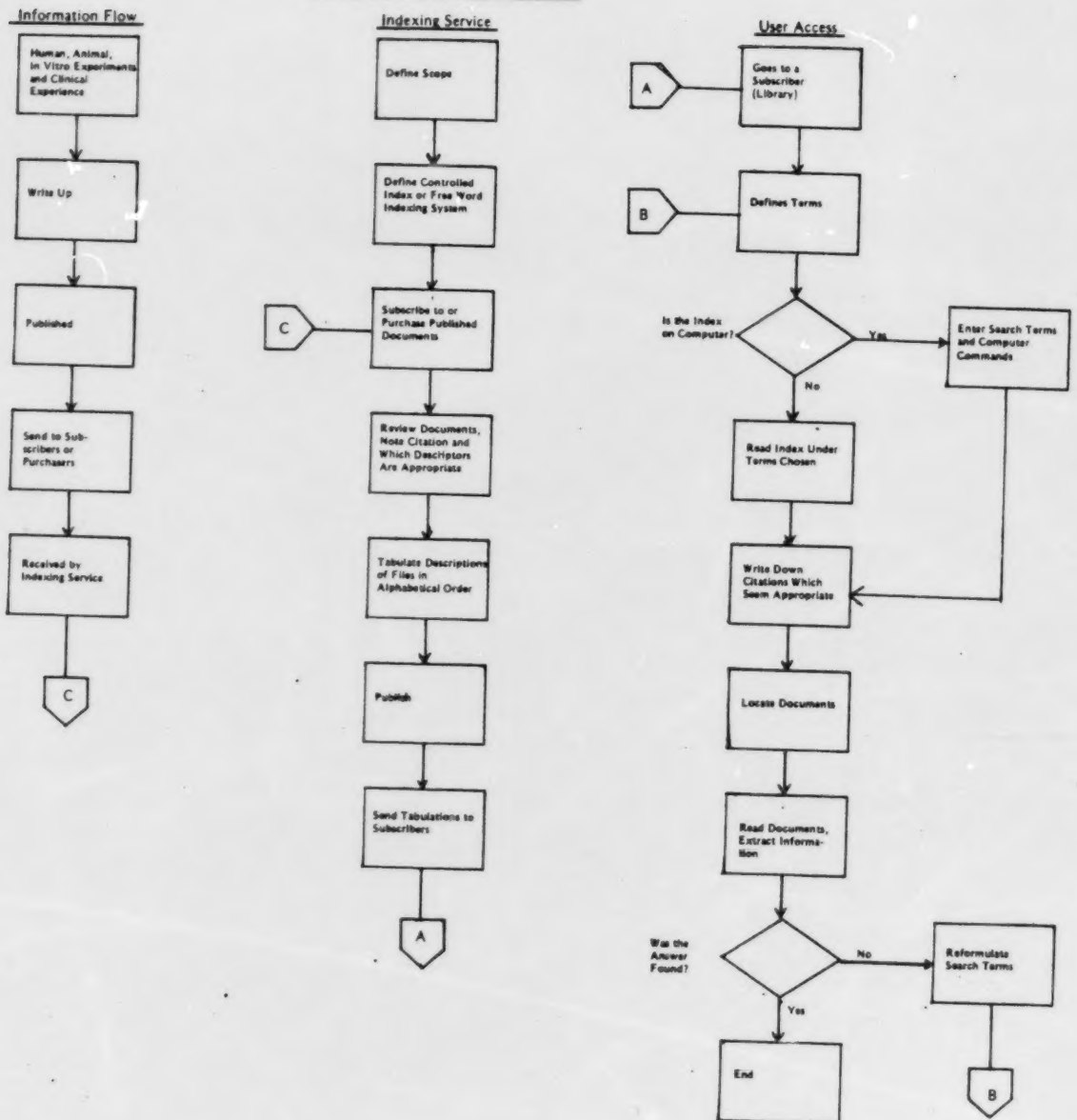


FIGURE 7 - TEXT AND REFERENCE BOOK SYSTEM

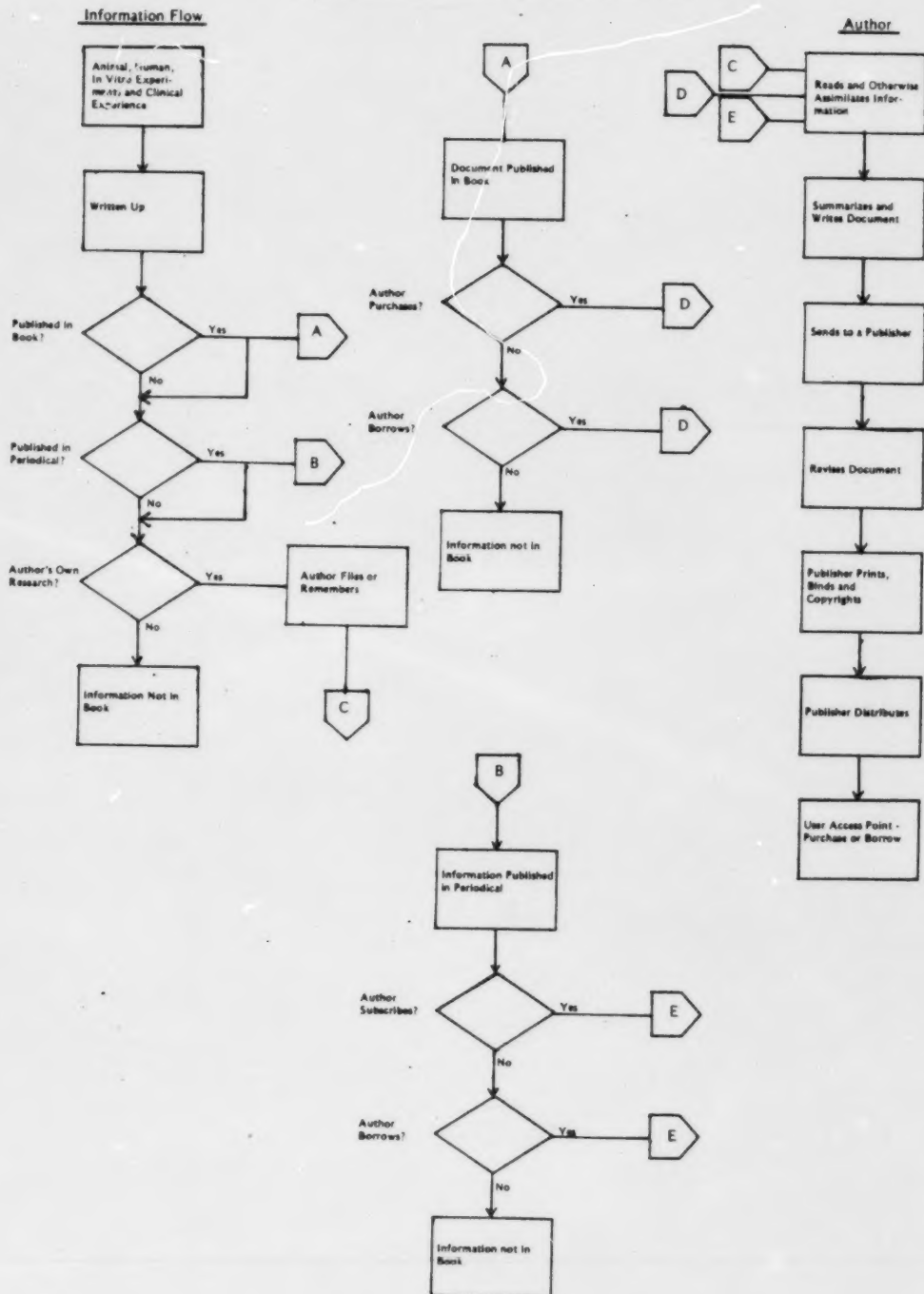


FIGURE 8 - PERIODICAL PUBLISHING SYSTEM

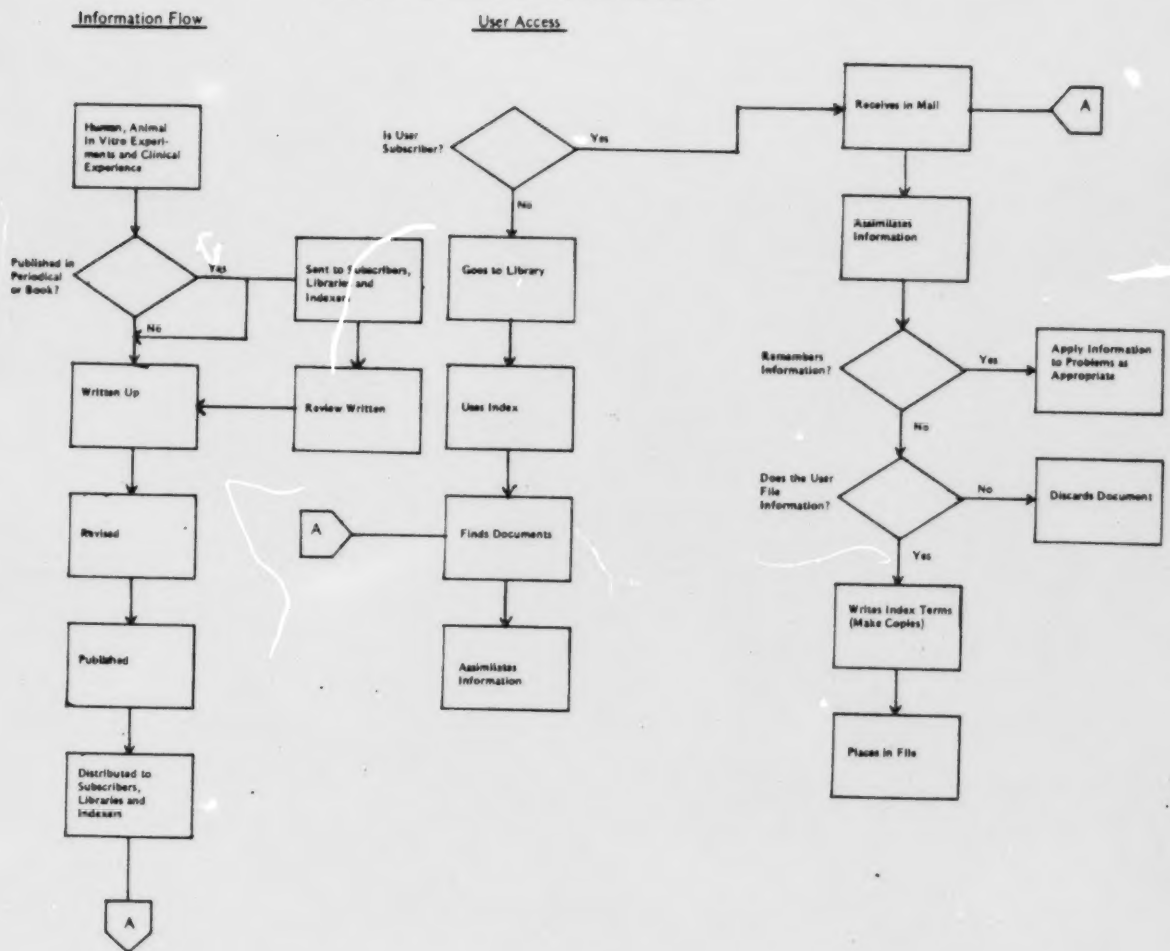


FIGURE 9 -- CURRENT INTEREST PROFILING SYSTEM

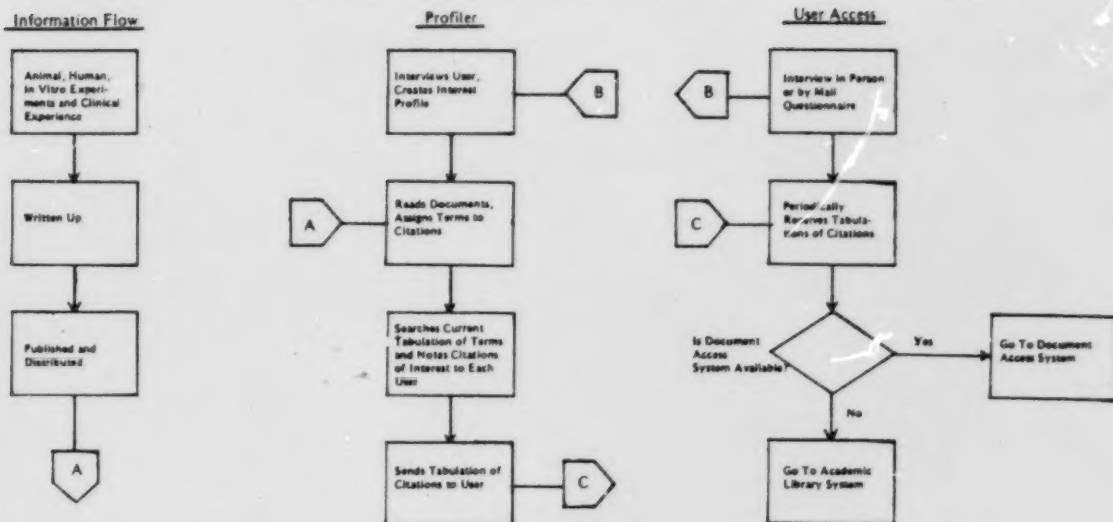
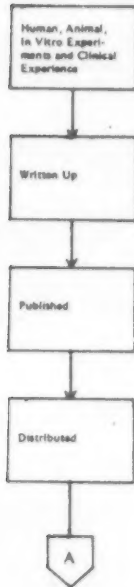
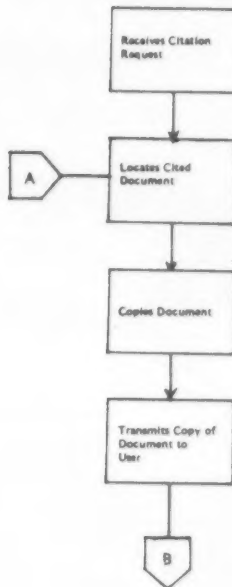


FIGURE 10 — DOCUMENT DELIVERY SYSTEMS

Information Flow



Intermediary



User Access

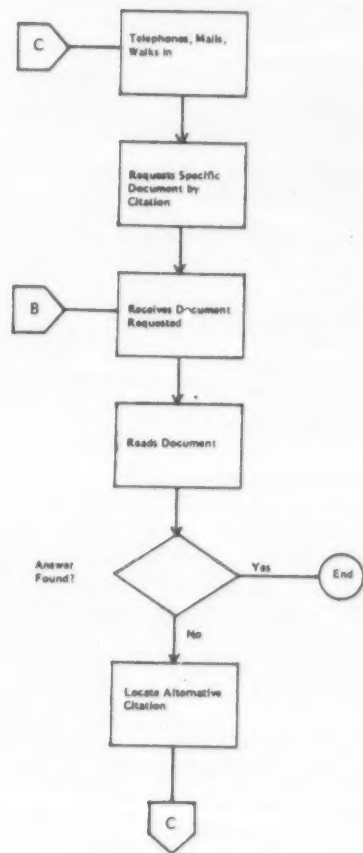


FIGURE 11 - ADVERTISEMENT SYSTEMS

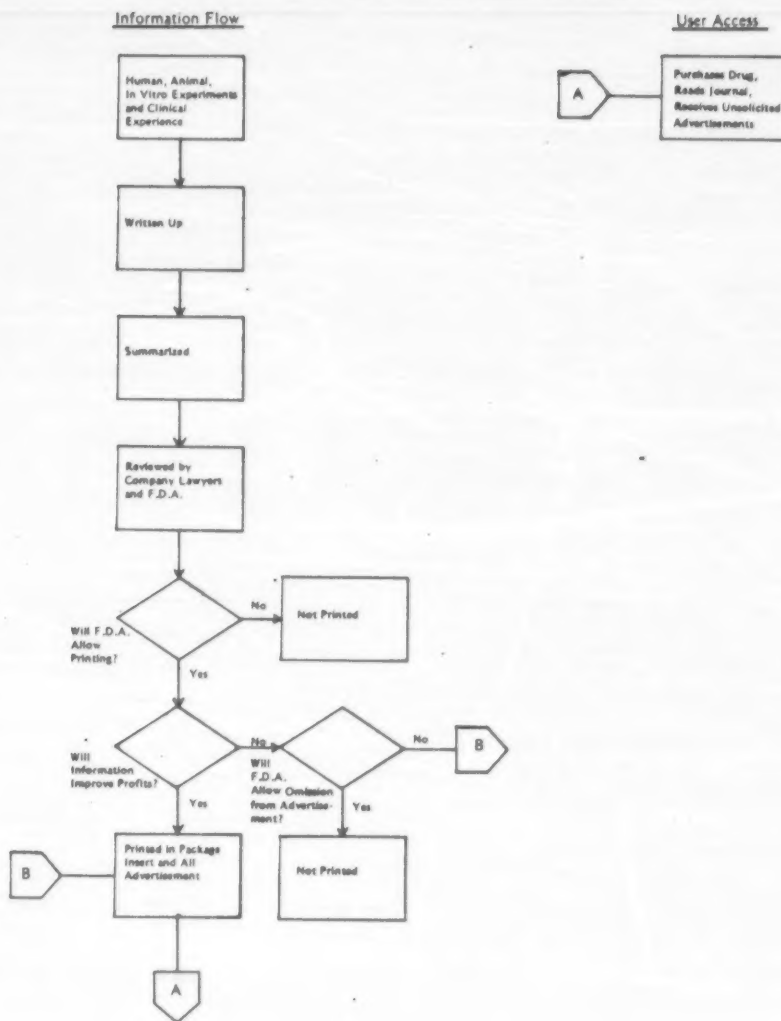


FIGURE 12 - PROPOSED SYSTEM (DIISS) OVERVIEW

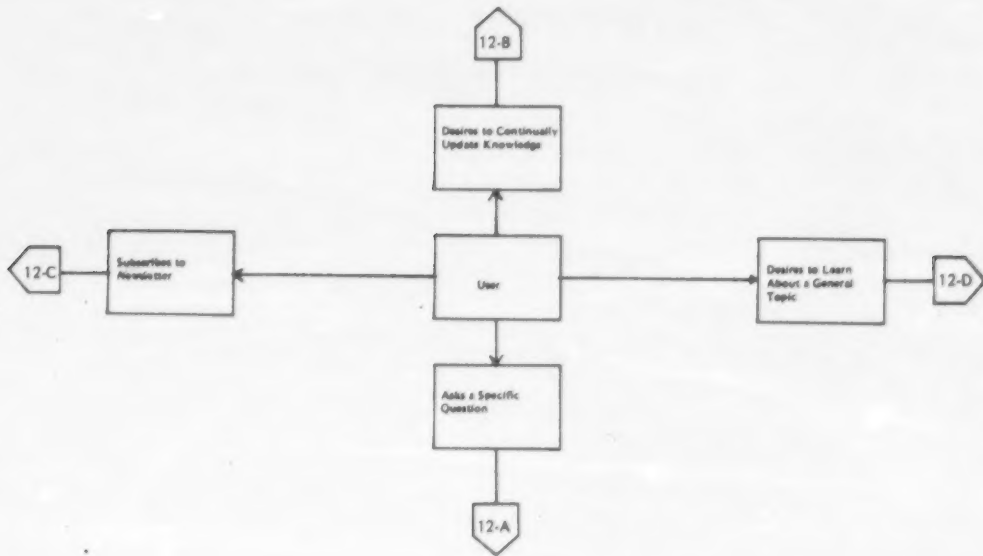


FIGURE 12-A-1 - SPECIFIC QUESTION SUBSYSTEM

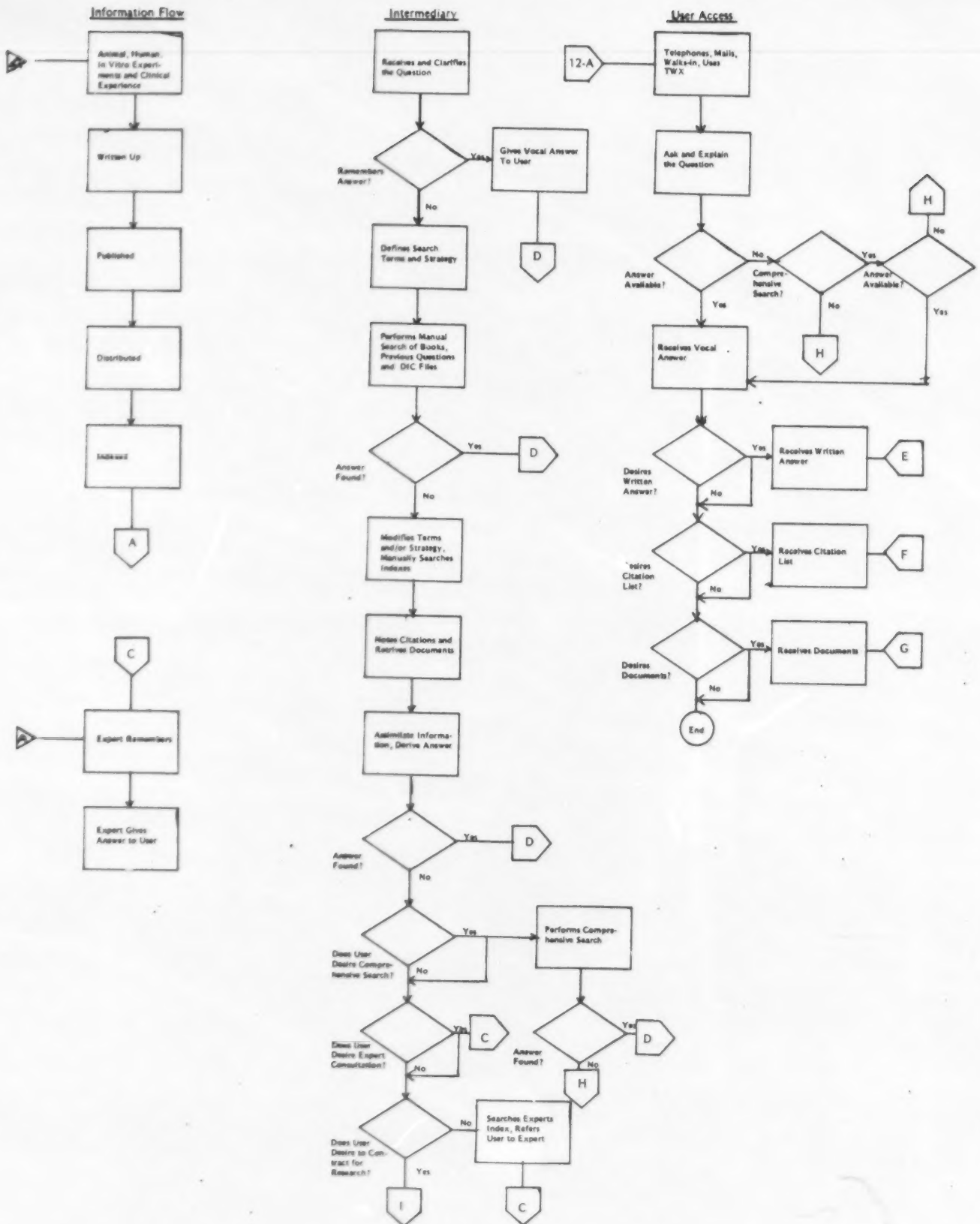


FIGURE 12-A-2

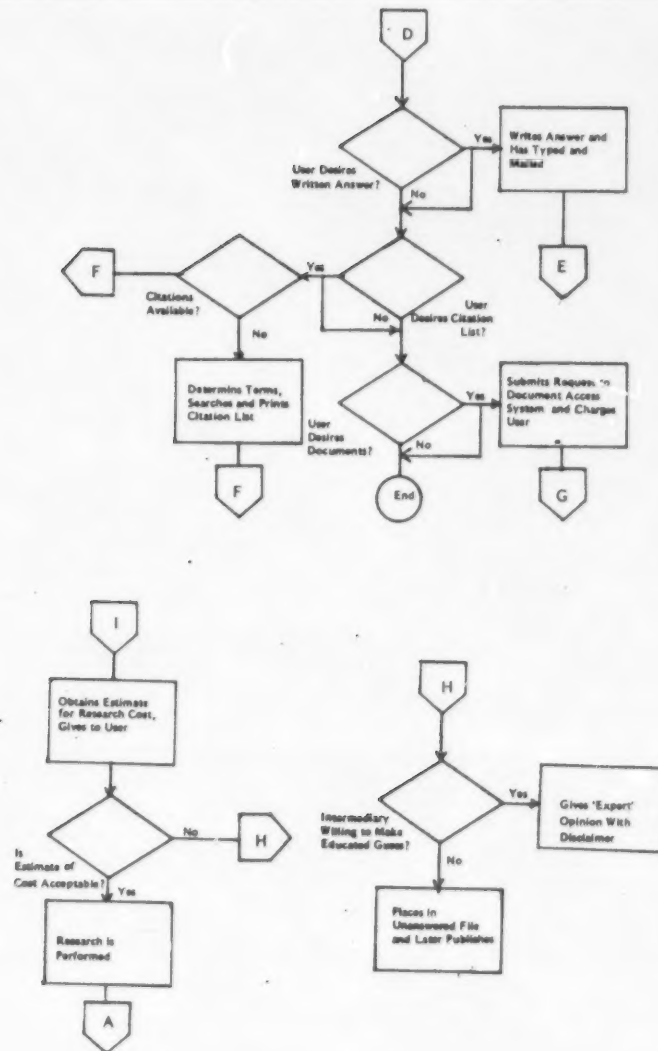
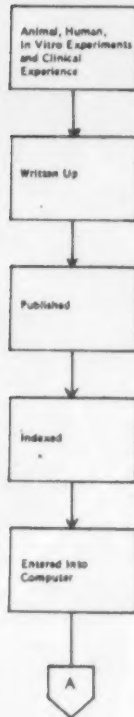
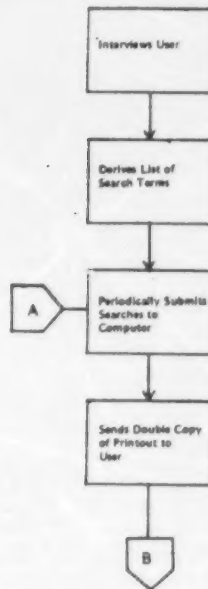


FIGURE 12-B - CURRENT INTEREST PROFILE SUBSYSTEM

Information Flow



Intermediary



User Access

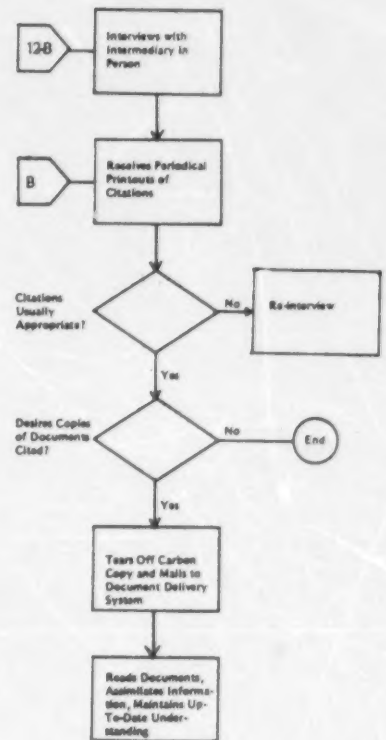
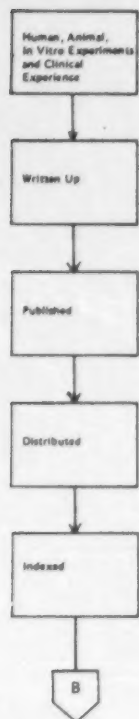
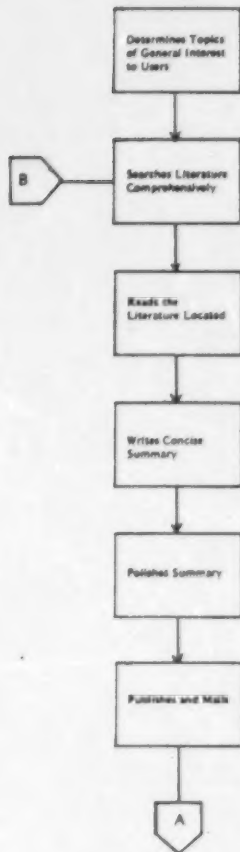


FIGURE 12-C - NEWSLETTER SUBSYSTEM

Information Flow



Intermediary



User Access

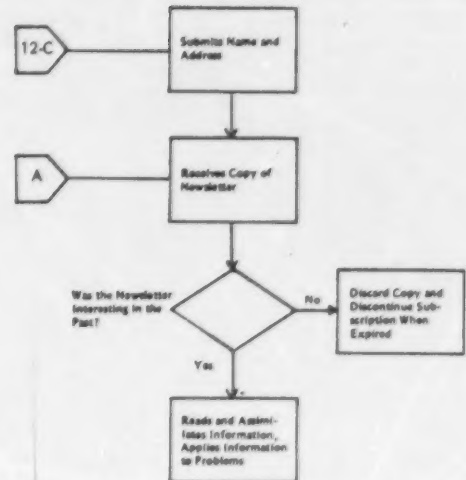
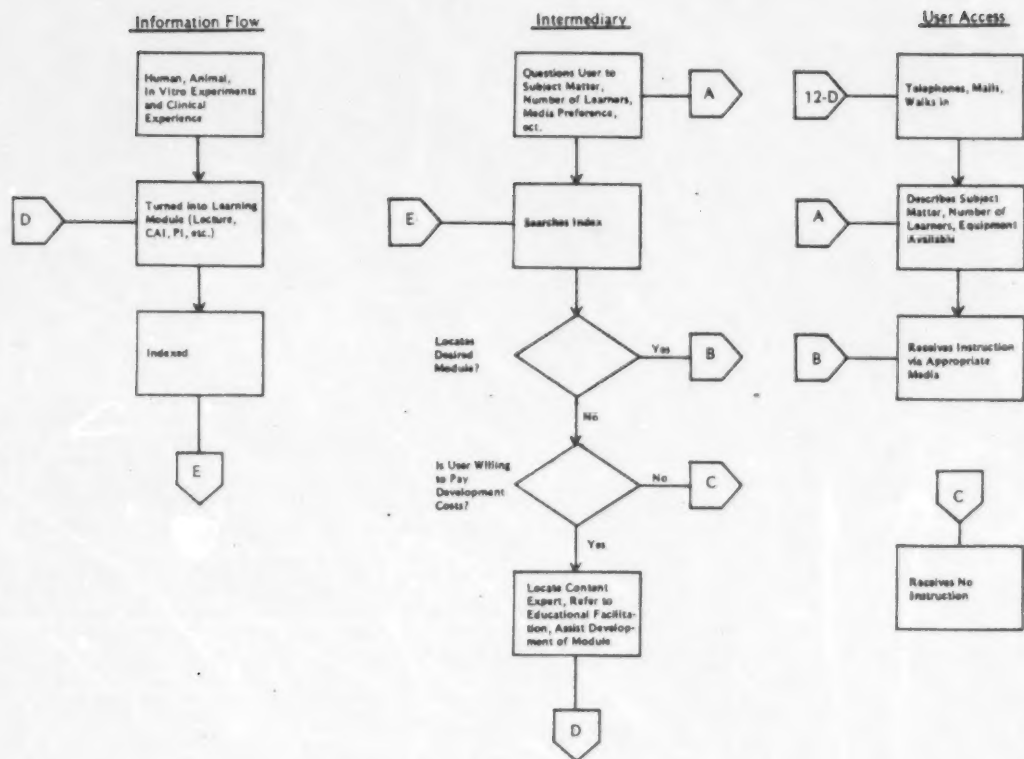


FIGURE 12-D - STRUCTURAL LEARNING EXPERIENCE SUBSYSTEM



APPENDIX A

A Short History of Information Systems

From the earliest times, man has sought to solve the problem of how to find the answer to a question. The first and most obvious way to find something out is to assume that it is a certain way and then discover whether or not your assumption is correct (i.e. trial and error). A formalization of this procedure is widely subscribed to today, being known as "The Scientific Method".

The scientific method is fine for those of us who have time to sit down and design an experiment every time we need to know something, but, let's face it, most of us would prefer something easier.

Man started working on this problem very early in history and developed two primary solutions to the problem. Both of them are widely used today. The first is to ask somebody who knows or thinks he knows. This system works fairly well but it relies upon the ability of a man to remember and communicate information. While this is not the perfect system, it beats doing an experiment every time. The major flaws in this system are that human memory is not perfect, and that men tend to die (at which point they are generally uncommunicative). Men tend to forget things or, worse yet, tend to "remember things incorrectly". The solution to this is to create a permanent record of the information desired. This solution works very well if there are only a few things to remember; but, when many things have to be permanently recorded, a new problem is created -- How to find the information that is needed amongst all the other information available. The solution to this problem is far from easy. In earlier times, it was satisfactory to approach this problem by starting at the beginning of a given collection of information and looking through it until the information desired was located. Alternatively, one could try to remember where one put all of the information in a given collection. This, again, depends upon memory and communication. The next logical step was to keep an index or a record of where what information is kept. Today, there is so much information recorded that to keep track of which index to use and how to use it has become very difficult. Persons who specialize in knowing this information are known as librarians or information scientists.

Mankind has not really progressed in its information storing and retrieving systems in the centuries since the invention of the printing press. Information systems are still highly dependent upon paper and, for the most part, require elaborate manual indexing, filing, and retrieving systems. Magnetic tape indexes

are created for computerized searching of the literature, but these are not created until after paper format documents are received by the indexer. These indexes are also useless if the user cannot obtain a readable copy of the document cited in the computerized search. Some advance systems provide a microform copy of documents cited along with the index, but neither the index nor the microfilm can be generated until the paper copy is received by the system provider. A major difference is that the user reads a copy not the original. Only in the most technologically advanced circles are we beginning to see information transfer without paper. (*)

We are still a long way from the system described by Thea Hodge in which computer terminals are available everywhere and the user needs only to state the question in whatever language or idiom desired to receive the answer. We are still a long way from making optimal use of currently available technology.

(*) Several microcomputer user groups have begun distributing magnetic tape copy of their journals. These are readable only by members who own standardized equipment, usually a hobby computer.

APPENDIX B

The Pharmaceutical Industry's Obligation to Clinical Pharmacists (Adapted from Katz, S. and Triboletti, M.: Drug Intelligence and Clinical Pharmacy 11:740-742 (Dec.) 1977.)

- I. Name
- II. Chemistry
- III. Physical Problems
- IV. Description
- V. Indications
- VI. Mechanism of Action
- VII. Biopharmaceutics
- VIII. Method of Detoxification and Elimination of Drug
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